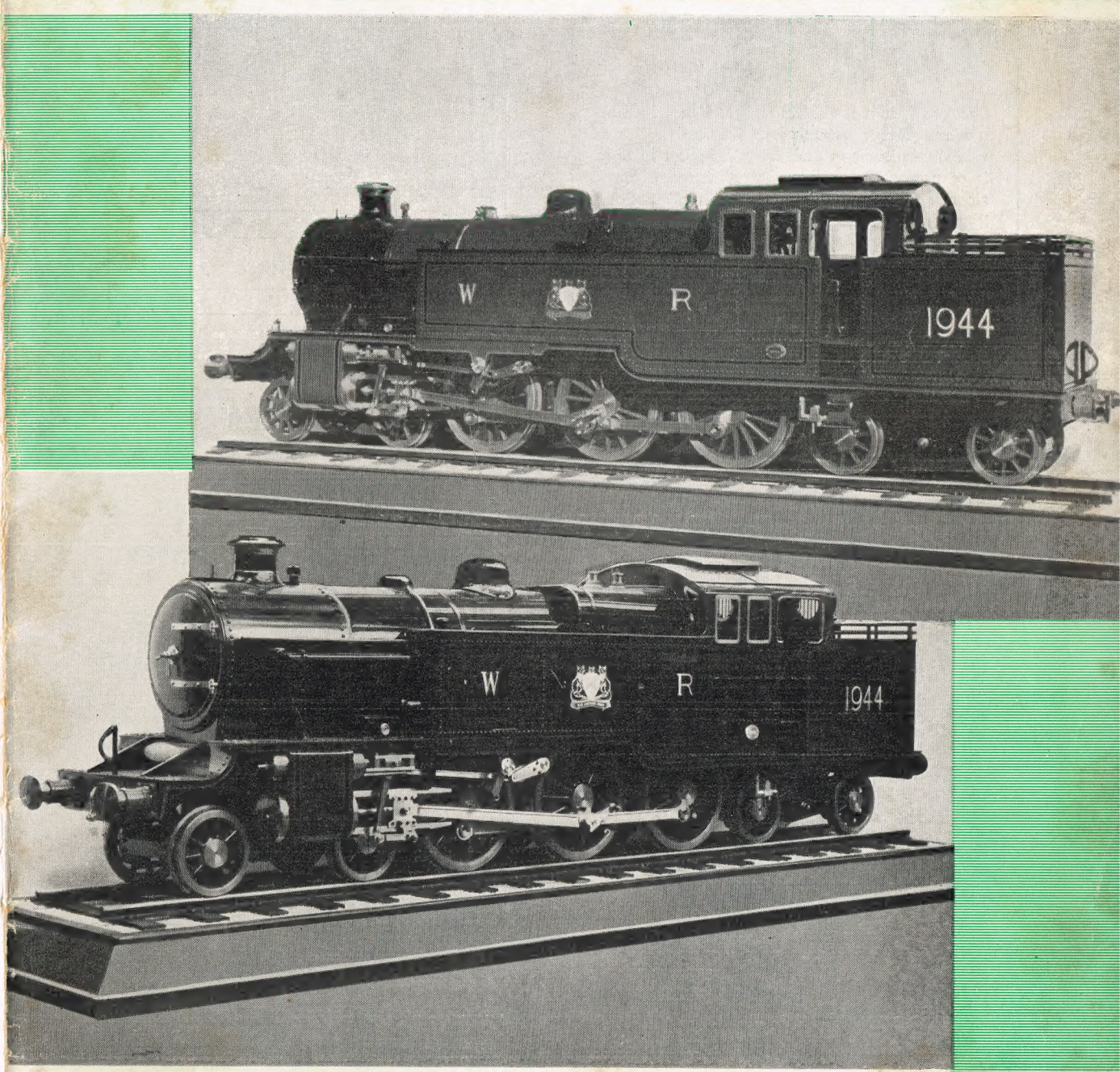
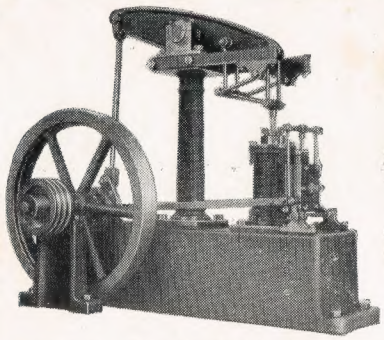
Battle

Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



ONE SHILLING 30 MAY 1957 VOL 116 NO 2923



Why a BEAM ENGINE?

Because it is a fascinating engine to watch in motion. Every moving part (except the Slide valve) can be seen and Watts' Parallel Motion is of never failing interest. Because it runs slowly, it only needs a quite small boiler. It is one of the Simplest engines to build.

Complete set of castings and all materials

£3 17s. 6d.

Including postage & Purchase Tax £5

Abroad: there is no Purchase Tax

Our catalogue is 1s. post free.

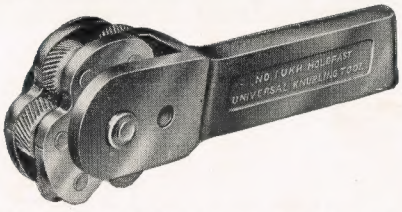
STUART TURNER LTD

HENLEY-ON-THAMES, OXON

D.S.T. *highest quality*

UNIVERSAL KNURLING TOOLHOLDER

WITH REVOLVING HEAD



Material EN351 Nickel Chrome Case-hardened Steel to Brinell 620 (Min.).
Machined top and bottom square to sides, with revolving head and three pairs of spiral knurls.

Model No.	Size of Holder	KNURLS			
		Dia.	Width	Width of Cut	Bore
1 UKH	$\frac{1}{2}$" × 1$\frac{1}{8}$" × 6$\frac{5}{4}$"	$\frac{3}{4}$"	$\frac{3}{8}$"	$\frac{5}{16}$"	$\frac{1}{4}$"

PRICE: With Cast Steel Knurls, **42/-**. With High-speed Steel Knurls, **52/6.**

DENFORD SMALL TOOLS

VICTORIA WORKS · BIRDS ROYD

'Phone BRIGHOUSE 64

THE NEW

KINWEST

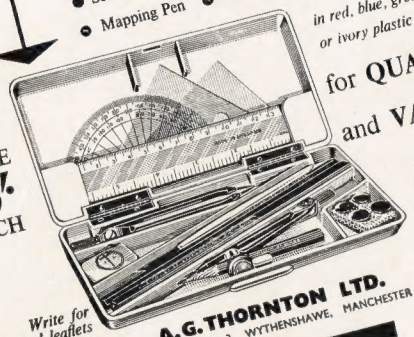
GEOMETRY SET

- Nickel plated Compass and Divider
- Protractor
- Set Squares 45° and 60°
- 6 in. Rule
- Mapping Pen
- Pencils
- Eraser
- Drawing Pins.

in red, blue, green or ivory plastic case.

for QUALITY and VALUE

PRICE **15/-** EACH



Write for illustrated leaflets and address of your nearest stockist to:

A.G. THORNTON LTD.
P.O. BOX 3, WYTHENSHAWE, MANCHESTER

MANUFACTURERS OF FIRST QUALITY DRAWING INSTRUMENTS
P.I.C. SLIDE RULES AND DRAWING EQUIPMENT

BOND'S

Model Racing Car Parts

Tyres and Wheel Centres

Solid rubber tyres and aluminium disc centres.

1"	diam. tyre with centre	Price **7/6** set 4
1 $\frac{3}{8}$"	diam. tyre with centre	Price **9/-** set 4
1$\frac{1}{4}$"	diam. tyre with centre	Price **9/-** set 4
2 $\frac{5}{16}$"	diam. tyre with centre	Price **27/6** set 4

SOLID TYRES

1$\frac{1}{2}$"	diam. solid rubber tyres	Price **5/-** set 4
2"	diam. solid rubber tyres	Price **11/-** set 4
2$\frac{1}{8}$"	diam. solid rubber tyres	Price **13/-** set 4
2 $\frac{5}{16}$"	diam. solid rubber tyres	Price **15/-** set 4
2$\frac{1}{2}$"	diam. solid rubber tyres	Price **16/6** set 4

AIR CORED RACING TYRES

3$\frac{1}{2}$"	diam. air cored tyres	Price **12/6** set 4

GEARS

High tensile steel Bevel Gears.

1$\frac{1}{2}$-1 ratio, pinion $\frac{3}{16}$" bore, crown wheel $\frac{1}{4}$" bore ...	Price **29/2** pr.
1$\frac{3}{4}$-1 ratio, pinion $\frac{3}{16}$" bore, crown wheel $\frac{1}{4}$" bore ...	Price **29/2** pr.

High tensile steel stub tooth spur gears.

.750" pitch diam., 12 teeth, $\frac{5}{16}$" bore	Price **7/4** each
1.00" pitch diam., 16 teeth, $\frac{5}{16}$" bore	Price **8/6** each
1.75" pitch diam., 28 teeth, $\frac{3}{8}$" bore	Price **20/7** each
2.00" pitch diam., 32 teeth, $\frac{3}{8}$" bore	Price **29/9** each

Packing and Postage extra.

Bond's Model Railway, Boat and Aeroplane Catalogue ... Price **2/-**

Bond's Gear, Tool, Steam Fitting and Material Catalogue ... Price **1/9**

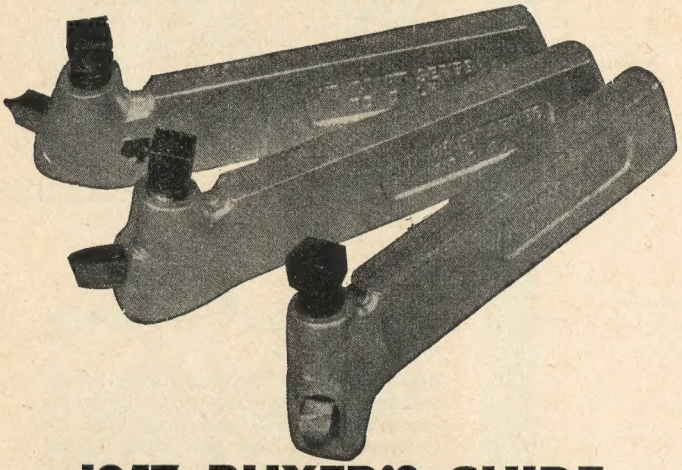
BOND'S O' EUSTON ROAD LTD

357 Euston Road, London, N.W.1

Est. 1887 Phone : EUSton 5441-2

YOU CAN TURN TO GOOD ACCOUNT

All the information given in our



1957 BUYER'S GUIDE

In every engineering shop you will find it, well thumbed and obviously treasured for its concise intelligence on the best in workshop equipment. Obviously we want you to have it—it brings our living—you need it for a window on what is best for your workshop today.

* Whilst writing ask for our illustrated leaflet on modern lathe tooling—its free.

—CUT HERE—

To: T. GARNER & SON LTD., Hand & Machine Tool Division
6-8, Primrose Hill, BARNSLEY

I/We enclose POSTAL ORDER value 1/6. Please mail your 1957 BUYER'S GUIDE to:—

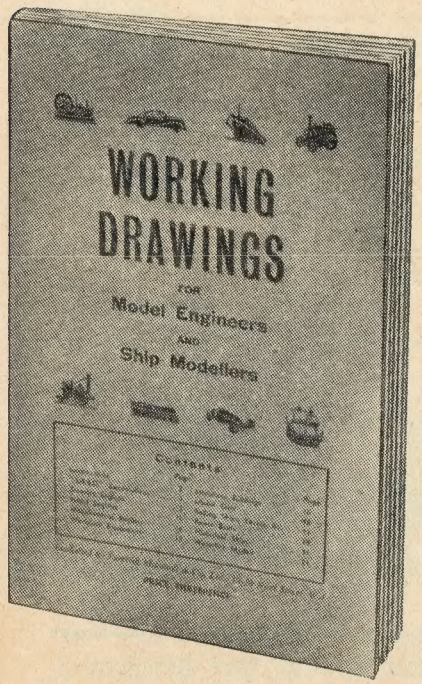
NAME (Block Letters please).....

ADDRESS .....

TOWN..... COUNTY.....

COUNTRY (Overseas Orders Only).....

A NEW BOOK. "Getting Started With Power Tools." Proving to be a BEST SELLER. **5/9 Post free (Mainland only). ORDER NOW.**



REVISED EDITION

OF THE

CATALOGUE OF WORKING DRAWINGS

NOW READY PRICE 3d.

Lists plans previously published in *Model Engineer* and *Ships & Ship Models* for the building of

Locomotives
"L.B.S.C." Locomotives
Traction Engines
Petrol Engines
Miscellaneous Engines
Workshop Equipment
Miniature Buildings
Model Cars
Sailing Ships, Yachts, &c.
Power Boats
Historical Ships
Waterline Models

Models listed were designed by specialists including: J. H. Ahern, G. W. Arthur-Brand, J. A. Austen-Walton, O. B. Bolton, E. Bowness, R. J. Collins, "Duplex," W. J. Daniels, Rex Hayes, W. J. Hughes, "L.B.S.C.," A. W. Littlejohn, C. B. Maycock, J. N. Maskelyne, Clive Millward, Stanley Rogers, C. Swift, A. D. Trollope, H. B. Tucker, E. T. Westbury.

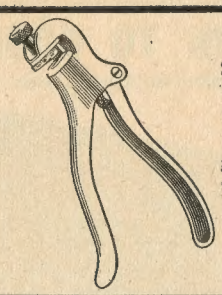
Send 6d. P.O. for post paid copy to :

PERCIVAL MARSHALL & Co. Ltd.

19-20, NOEL STREET, LONDON, W.1

Eclipse

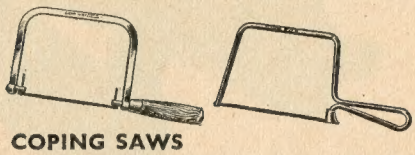
makes accuracy easy!



SAW SET

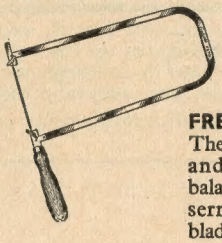
For setting the teeth of hand saws — one progressive movement first grips the saw and then sets the tooth; also larger models for circular saws and cross cut saws.

Price: 18/6



COPING SAWS

The high quality nickel-plated frame for the craftsman, with swivelling tension pieces for easy adjustment of the blade to any angle. An inexpensive blade frame with rubber fingered guard. Price: 7CP - 5/6 27W 1/9



FRET SAWS

The full range of blades and a rigid and well balanced plated frame with serrated and hardened blade clamps.

Price: 7/-

TANK & WASHER CUTTER

A dual purpose tool for use in a joiner's brace for cutting holes in sheet metal, tanks, etc., or for cutting washers.

Price: 22/6

BIT GAUGE

A simple but effective tool for attaching to auger bits from $\frac{1}{8}$" to $\frac{3}{4}$"; to facilitate the boring of holes to a predetermined length.

Price: 5/3

Made by James Neill & Co. (Sheffield) Ltd., and obtainable from all tool distributors

UBI

Model Engineer

30 MAY 1957 VOLUME 116 No 2923

Subscription 58s. 6d. (U.S.A. and Canada $8.50) post free

Published every Thursday

Incorporating SHIPS AND SHIP MODELS

IN THIS ISSUE

767 Smoke rings
769 Atomic energy
772 St Ninian—II
775 Beginner's workshop
776 Aids to efficient running
778 Muncaster models—8
781 Reaction testing device
782 50 years ago
784 Locos I have known—34
786 L.B.S.C.
789 Mixed bag
792 Expert's workshop
794 Miniature generating plant
796 Readers' queries
798 Postbag
801 Club news

NEXT WEEK

Bracket clock: Details of the construction of the Championship Cup winner

Speedboat competition: Review of the trends and some successful models

Jimpy: How an enthusiast built a back garden locomotive

Myrmidon—6

Tailstock for a Drummond

The Editor is pleased to consider contributions for publication in MODEL ENGINEER. Manuscripts should be accompanied by photographs and/or drawings and should have a stamped addressed envelope for their return if unsuitable. None of the contents of MODEL ENGINEER may be reproduced without written permission. All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W.1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

THE traction engine will not die while there are people like Mr Vivien Kirk, of Oxford, for Mr Kirk is one of several Oxford enthusiasts who have so far saved five handsome road and fairground engines from a rusty extinction.

" Five nights a week and weekends too," says *The Oxford Times*, Vivien Kirk spends down at The Lakes, Wolvercote, tending the engines, three of which he owns.

Between them the group own *Queen Mary*, a 1920 showman's engine, *General Gough*, a 1921 Burrell's engine, *Old Bill*, a 67-year-old road-roller (these three belong to Mr Kirk), *Forest Queen*, a Burrell 6 h.p. single-crank compound (owned by James Whale, and the *Duke of Wellington*, a 5-ton tractor (Richard Jolly).

I like to feel there is an " old " live steamer associated with these ventures, and sure enough there is. His name is Mr H. Trinder and he used to drive these reliable stalwarts until as recently as 1947. Now he has been adopted by the group as the " engine's doctor " and it is his skill with his patients that has put the scheme " on its feet," as Mr Jolly expressed it.

To " Doctor " Trinder will fall the honour of driving *Old Bill* at the Appleford rally to be held at Didcot in June.

Talyllyn stamps

TALYLLYN railway has now joined the majority of the railways in Great Britain and Northern Ireland in the acceptance of letters for conveyance by passenger train. The extra fee payable, up to 2 oz., is 11d. and a very attractive series of stamps has been prepared for affixing to letters originating on the Talyllyn.

The procedure is for the letter or card (which must already bear the usual postage stamp) to be handed in at the booking office, where the additional stamp will be affixed and cancelled, after which the item will be conveyed to any other station on the railways party to the agreement, to be called for or, if desired, posted for local delivery.

It is hoped that this facility will be made use of locally, and also that the stamps themselves, each of which includes a scene on the railway, may be of interest to collectors.

There will be six different scenes and a number of colour variations.

Preserving locomotives

THERE appears to be quite a lot of discussion among locomotive enthusiasts as to whether attempts should be made to restore old locomotives to their original condition when they are retained for permanent preservation. It arises out of the fact that in not one single case where restoration has been attempted has the result been entirely satisfactory.

Smoke Rings . . .

The best example to date is probably the Adams 4-4-0 No 563 of the former London and South Western Railway; this engine, when compared with photographs of her in her original condition, shows only one error, apart from the Drummond style of painting (which is perfectly accurate for one period of her existence), and it is that her two whistles are the wrong way about.

The Great Western *City of Truro*, very lovely though she looks, is painted and lined in a style that was never current on the G.W.R. at *any* time. The two Great Northern Atlantics Nos 990 and 251 are painted in two different liveries, whereas they should be alike, while the Caledonian 4-2-2, from the " original condition " point of view, is little better than a complete anachronism.

Guesswork ?

It certainly appears that attempts at restoration have been very largely matters of guesswork, which may be due to official records having been mislaid or destroyed; and perhaps memories dimmed with regard to details.

In view of all this, the question arises whether a better and more satisfactory policy would be to leave any preserved locomotive in the condition in which she was at the time of her withdrawal from service, rather than attempt to restore her to her original condition and so produce a result that is unsatisfactory and historically inaccurate. I believe that the majority of our locomotive enthusiasts would prefer this course.

On the other hand, as recent letters published in MODEL ENGINEER have clearly shown, many readers are very anxious that their model locomotives shall be accurate in details and appearance for some particular period; but what hopes have they when official particulars are no longer to be trusted ?

I know that the Historical Model Railway Society is making valiant and strenuous efforts to solve the problem; maybe, in due course, it will be in a position to publish its findings. But the problem does not concern locomotives alone; it applies to historical models of all types.

Wanted—a museum

IT is surprising that a town which lives largely by ships and fishing should allow a valuable collection of ship models and paintings to be left in a cellar under its Council offices, covered with dust sheets, for 16 years. Yet this is what has actually happened at Grimsby !

It appears that the collection, which is valued at £20,000, was bequeathed to the town at the beginning of the war by the late Mr Wilfred Veer Doughty, son of a former Grimsby M.P. and trawler owner, Sir George Doughty. The reason given for not having the models on show is that the town cannot afford a museum.

But surely some arrangement could be made, even if it is only to find space in the Council offices, so that the people for whom the collection was intended should have the opportunity of enjoying it.

There is also the larger circle to consider, the students and ship-lovers from other parts of the country to whom it would certainly be of interest and for whom it might contain valuable information.

Prophylaxis

THE importance of occupational therapy has now been fully recognised by the medical profession as a valuable aid to curative treatment or convalescence in both physical and mental ailments. Particularly in the latter case, almost any form of activity which involves co-ordination of hand and brain has been found helpful, and especially creative work such as modelling from raw materials of any kind. Many instances have been brought to our notice, some of them at first hand, where such work has undoubtedly contributed to the cure of mental disorders.

But why leave it at that ? Surely it is logical to assume that if creative work will aid the cure of an ailment, it may be even more effective in combating the root causes which lead to such ailments—and everyone knows that prevention is better than cure. I believe that in the present conditions of life, when so many people are suffering from jaded nerves and general overstrain, a creative hobby may be a means of preserving sanity.

Model engineering is often regarded as a mild form of madness by those who cannot appreciate its attractions; but, even so, it is surely a more healthy and harmless form of madness than the depression and melancholia of the many people who have no hobby to give them a real interest in life.

Cover picture

This locomotive is a 5 in. gauge 4-6-4 *tank designed and built by Mr C. R. Fox, of the Harrow and Wembley Society of Model Engineers. It has cylinders* 1½ *in. dia.* × 2¼ *in. stroke, and is fitted with semi-balanced D-valves designed to offset some of the pressure on the working parts. It won a bronze medal at the* 1955 *M.E. Exhibition.*

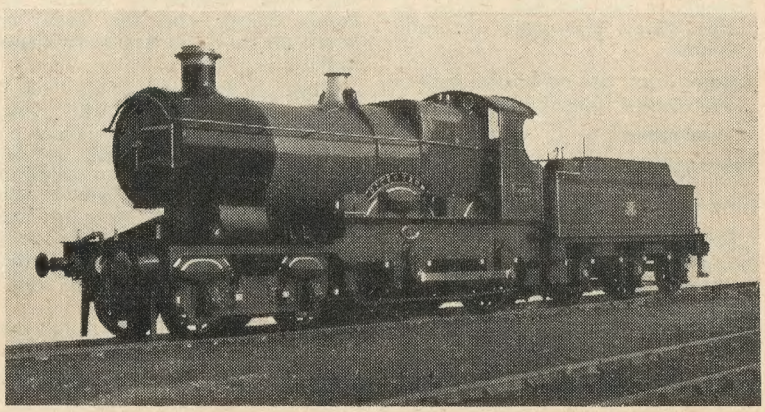
Sail training race

THE next sail training ship race will start on 2 August 1958. That was the forecast of Captain J. H. Illingworth, R.N.(Rtd), in a lecture to members of the Little Ship Club. And instead of beginning from Torquay as last time, the race would probably be from Brest, westwards round Madeira to Las Palmas in the Canaries.

It was likely that several more ships would be taking part—indeed, some were now being built, including an Argentinian 4,000 tonner for which Capt. Illingworth had been asked to do the sail plan.

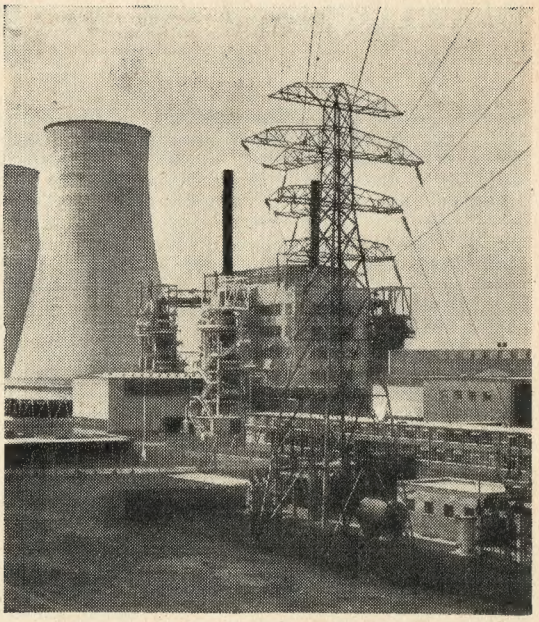
In 1960 the race was likely to be from Scandinavia round Scotland to Gibraltar.

CITY OF TRURO, *which the Western Region of British Railways claim has been painted in her original style since coming back into service*



THE DEVELOPMENT OF ATOMIC ENERGY

Being the text of the recent Baghdad Address by Sir John Cockcroft



We are living today in a world dominated by a great development of science and technology, bringing to us new wealth as man's power over Nature steadily increases.

I have worked now for over 30 years in science and technology, beginning my scientific life in the Cavendish Laboratory at Cambridge when Lord Rutherford was director. The years from 1932 to 1939 were a Golden Age for nuclear physics and the Cavendish Laboratory, for it was during these years that Sir James Chadwick discovered the elementary atomic particle, the neutron; Dr Walton and I discovered what are now known as the fusion reactions—the release of energy from nuclei by the light atoms; the radioactivity of the common elements was discovered in France and finally and inexorably the fission of uranium was discovered by Hahn.

Important as these years were in the development of physics, they have been surpassed by the discoveries and developments of the last decade. In physics we have probed further and further into the nature of the basic forces of the universe—the forces which hold atomic nuclei together and are responsible for the enormous magnitude of the so-called "atomic energy"—the energy of the sun and stars. So we build giant machines to make atoms collide at enormous speeds. When they collide, strange new sub-atomic particles—the mesons—are created like sparks, often changing quickly from one variety of meson into another. A great many of the discoveries in this sub-atomic world have been made in British universities during these last years.

We have also succeeded in these 10 years in turning these enormous forces of atomic nuclei to practical use—to produce electricity on a large scale for use in our houses and factories in Britain. This was achieved in the Calder Hall nuclear power station which came into operation in May of last year. [The heading picture illustrates the near-completion of the station.]

Calder Hall obtains its heat from two giant nuclear furnaces called reactors which replace the boilers of ordinary power stations. Each reactor is contained in a giant steel cylinder 11 meters in diameter. Inside the cylinder are 1,200 tons of bricks of very pure graphite. Vertical channels are left between the bricks and in these are stacked, one above the other, bars of uranium metal sheathed in a magnesium alloy. In other vertical channels there move so-called control rods which control the amount of heat developed in the nuclear furnaces. When the control rods are withdrawn, nuclei of uranium atoms start to split up and the uranium rods get hot. The heat is transferred by circulating carbon dioxide gas to four large cylinders filled by water tubes. So the water gets hot and is turned into steam. The steam is then used to drive steam turbines in a quite normal kind of power station. The four steam turbines of Calder Hall generate about 90,000 kilowatts of electricity.

One of the important advantages of a nuclear power station is that a charge of uranium metal will last for a very long time. If left undisturbed the reactor would go on steadily producing heat for six or seven years. So nuclear power stations will need nothing like so much in the way of roads and railways capable of bearing heavy traffic.

Our experience in bringing this pioneering station into operation has been very satisfactory. It has started life with far less trouble than a conventional coal- or oil-fired power station, or chemical factory. It delivers its output smoothly to our national grid and its output can be varied more quickly than a normal power station to suit varying loads.

There is in fact very little to go wrong in the reactor except the uranium fuel elements and the conventional mechanical parts, such as motors and fans. The only new phenomenon was a kind of plasticity in uranium metal which we had predicted by research work at Harwell and confirmed in the operation of Calder Hall. This has required some modification to the support of fuel elements.

The Government has recently decided to expand its programme of nuclear power stations and is going to build 19 such stations by late 1965. The first of these will have four times the electrical output of Calder Hall. This is partly because they will be larger, but also because they will develop twice as much heat for a given

DEVELOPMENT OF ATOMIC ENERGY

volume. So the first of these stations, which will come into operation in 1960, will produce about 300,000 kilowatts of electricity, and by 1965 about one quarter of our electricity production will come from these nuclear power stations. Thus by then they will be developing as much electricity as would be produced by the burn-up of 18 million tons of coal a year or 10 million tons of oil.

We do not expect that electricity will at first be generated more cheaply from nuclear energy; indeed, to begin with, it will be about 10 per cent. more expensive than electricity from coal- or oil-fired stations. However, three-quarters of the cost of the electricity will be due to the high capital charges of the nuclear power stations—the first stations will cost over £35 million pounds each. During the period 1960-1965 the output of individual nuclear power stations is likely to increase two or three times and there are large economies in increasing the scale. So we expect a rapid fall in capital costs, and nuclear power costs should reach parity with coal power costs by 1962 and fall below coal power costs by 1965.

In this country [Iraq] where oil and natural gas are abundant and where electrical demand is in any case not so great as to warrant the building of a nuclear power station on the United Kingdom scale, the cost of nuclear power would at present be much greater than the cost of electrical power from oil.

Smaller stations

In neighbouring countries there are likely to be regions remote from oil supplies or hydro-electric power where nuclear power might be attractive at a fairly early date. From my limited knowledge of the power requirement of these countries I would guess that nuclear power units developing from 10,000 to 30,000 kilowatts of electricity would be required. These can now be built. A smaller version of the Calder Hall power station developing 30,000 kilowatts of electricity would be possible. For smaller outputs a different kind of nuclear reactor would be preferred and we are working on several types which might be suitable. The cost of power for such stations in the United Kingdom would probably lie between 1½d. or 2d. per unit—about the same as the cost of power from diesel stations. But we do not know this with accuracy.

The importance of atomic energy is, however, that it gives to all countries the assurance that there will be ample energy available for man's needs for as far ahead as we can foresee.

This also means that in the course of time the irreplaceable fossil fuels such as oil will be used more and more as raw materials for chemical industry. They are already being so used in Britain. The crude oil is first turned into building bricks for the chemist—such as ethylene, propylene and butylene. Ethylene is then converted to valuable plastics such as polyethylene—used for insulating cables or for chemists' laboratory utensils and fittings—or to p.v.c. (polyvinyl chloride) used for bags. It can also be used for making fibres such as Terylene. Propylene is used as a building brick for other plastics; butylene is used for making synthetic rubber.

Other benefits

Atomic energy is providing other important benefits to mankind, through the application of radioactive isotopes, which are produced in nuclear reactors. Nuclear reactors are like the alchemist's furnace—they can transmute elements. At Harwell we use our reactors BEPO and DIDO for this purpose. One of the most important isotopes for biological research is radiocarbon—carbon 14. To make it we put a compound containing nitrogen into the reactor and in the course of a year a good deal of the nitrogen is transmuted by capturing a neutron into radiocarbon. The nitrogeneous compound is then sent to our radiochemical centre at Amersham and the radio carbon is separated and incorporated into a great variety of compounds which are used in biological research.

The compound is then said to be "labelled" by the radioisotopes. Since it now emits electrons which can be detected by a Geiger counter, the part of the molecule containing the carbon can be traced in its complicated passage through a living organism. It is just as though the biologist could see this part of the molecule throughout its passage from intake to excretion.

Its use has changed in a major way our ideas on metabolism of foodstuffs. Previously biologists thought of food as a kind of fuel to be used for supplying energy or repairing wastage in tissues. It seems now that the large complex molecules in food and the less complex compounds which form them continually take part in rapid chemical reactions. The fragment of the molecules form a kind of metabolic pool. Protein molecules are taken to pieces and

Sealing sulphur tubs before irradiation in the pile

reassembled in time of about half an hour. Even the crystalline structure of the bone is continually being rebuilt.

In a similar way it has been found that a component of the blood, such as iron, is continually being changed and half the iron present in blood plasma leaves it in 90 min., half of it finding its way to the bone marrow and half to the liver.

In a like manner carbon 14 has been used to study the processes by which plants take in carbon dioxide and, with the aid of light, turn it into our foodstuffs, sugar, starch and other complex compounds.

Another important radioisotope is radio phosphorus which is produced by placing sulphur in a reactor. The sulphur is transmitted to radio phosphorus. This can now be incorporated into fertilisers as phosphates and used to study the process by which plants such as wheat or barley take up phosphorus from the soil or fertiliser. It has enabled agricultural scientists to determine the best form of fertiliser to suit a particular soil or plant.

Radio cobalt is another important isotope. This is produced by inserting cobalt metal—cobalt 59—into DIDO. The cobalt nucleus captures a neutron and is transformed into cobalt 60—which emits a penetrating gamma ray—rather like that emitted by radium. The activity lasts for several years and is used for many purposes. One use in the oil industry is to take X-ray pictures of welds in pipe lines to make sure they are sound. This can be done in the field. Another use is to study the corrosion of pipe lines

by making measurements of thickness from the outside.

It has also important uses in medicine as an alternative to the very high voltage X-ray sets used for treatment of cancer. The radio cobalt is produced in the form of small cylinders and these are housed in a thick lead shield. The withdrawal of shutters then allows a beam of gamma rays to emerge and it is directed on to the tumour.

Another radioactive isotope—radio caesium—is now being extracted from the radioactive waste products which are separated from spent uranium rods. They are a kind of nuclear ash. So we now have a cheap radioactive material which can be used instead of the X-ray sets to look for broken bones or other abnormalities. This material lasts for 30 years. So it could be of great value to remote districts without electricity supplies or means of maintaining X-ray sets.

Food preservation

Radio caesium may also in future be used for food preservation. Losses of foodstuffs can be very high in tropical countries—reaching 50 per cent., I'm told. Radiation from strong sources of radio caesium can be used to destroy bacteria in foodstuffs, and so enable its life to be prolonged provided bacteria can thereafter be excluded by wrapping. It can be used to prevent the sprouting of crops such as potatoes and onions. It can also be used to destory insects in grain. These applications of radiation to food preservation are being studied in Britain and in the United States. Their application to other countries will depend greatly on local circumstances and can best be studied locally.

Large radiation sources may be used in future by the oil industry, since radiation can promote chemical reactions and seem to be of special value in the production of some kinds of plastics such as polythene. The possibilities are being studied now by oil-research laboratories. The local refining industry may, therefore, be interested.

The development and application of atomic energy is only one facet of the rapid expansion of technology in the world. In many countries agriculture is being transformed by the use of chemical fertilisers, weedkillers, insecticides, plant hormones and the elimination of trace-element deficiencies. Wheat yields have been increased 400 per cent. in some countries and Britain has now one of the highest agricultural productivities in the world. Radioactive tracers have an important role in agricultural research on how these aids are best used.

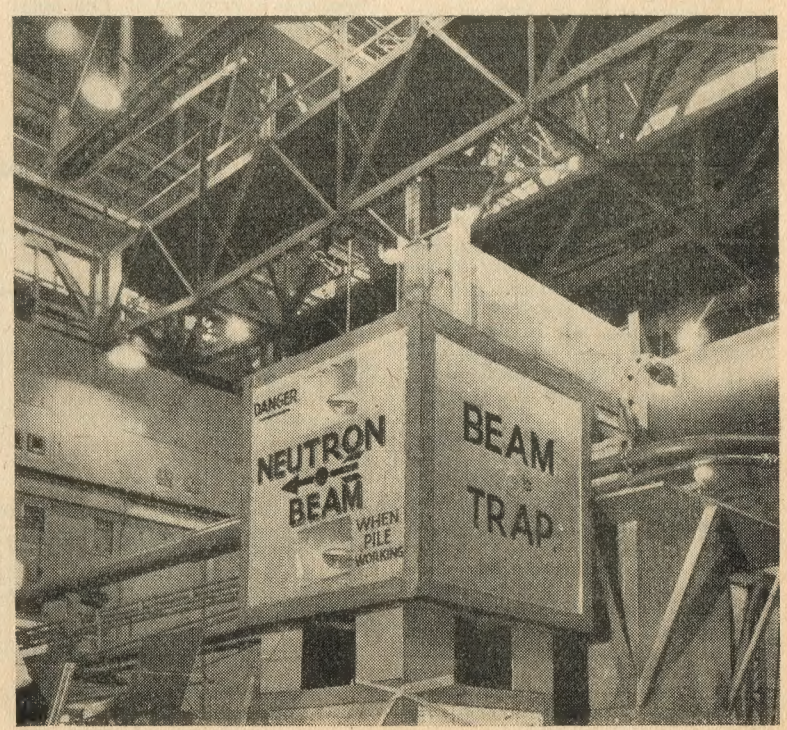
Although the introduction of nuclear power itself is likely in the early years to appeal mainly to fully industrialised countries which are short of conventional fuel, there are these and other benefits of more universal application to be gained from nuclear energy, with which this centre will be concerned.

The Baghdad Nuclear Centre has been founded to study radiation problems and to train students and graduates in the possible application of radioisotopes to medicine, agriculture and local industry. Harwell has provided the first director, Mr Whitehouse, and four of the initial staff. With him is a staff of eight from Iraq and allied countries—staff who have been trained at Harwell. We all hope that this strong initial connection and collaboration can continue and grow and that in this way our experience and abilities may help your economy.

These great benefits of science and technology are now available to all countries who have the scientists and technologists able to supervise their use. In our country the key to future improvement in our standards of living is to have an adequate supply of scientists and technologists. We have doubled our output from the universities in the last 10 years and we are planning to double it again as soon as we can, for science and technology are the principal sources of new wealth in the world. Each pound or dollar spent on scientific research is repaid 20 to 50 fold within a generation. So investments in universities and colleges of technology and technological research are the most rewarding investments a country can make today. Many of us in Britain feel that the greatest contribution we can make to the well being of the world is through our long tradition of scientific and technological discovery combined with the enthusiasm and ability of our present generation of young scientists who are as good as any in the world today.

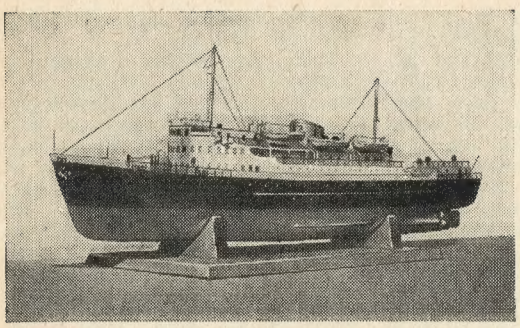
I hope that through our association with the Baghdad Laboratory there will be a much greater scientific collaboration between our countries. ■

The neutron time of flight tube attached to BEPO at Harwell. Pulses of neutrons with a range of speeds are released by a chopper mechanism into the tube. The time taken for the different speed neutrons to traverse the tube can be measured



PATENT APPLICATIONS

The Board of Trade have laid before Parliament rules under the Patents Act 1957 laying down the period within which an application for a patent must be put in order for acceptance. As was foreshadowed during the debates on the Act, the period laid down is three years six months from the date of filing the complete specification.



A WORKING MODEL OF ST NINIAN

By EDWARD BOWNESS

Part 11—This section deals with the boatdeck and wheelhouse and includes drawings giving dimensions of the parts needed

(*Continued from 16 May 1957, pages 706 to 708*)

Now that the promenade deck is in position the next task is the boatdeck. It is obvious that this deck will need some support in addition to that which it receives from the sides of the cabin on the promenade deck, so I am showing three cross-members (see *A* Fig. 54) which should be made and fitted at this stage.

They are made of thin tinplate with a flange $\frac{1}{8}$ in. wide all round. The upper edge is curved to suit the camber of the deck (the template mentioned in Part 8, April 18, should be used to check this), and at each end they are soldered to the inside of the cabins and $1\frac{1}{4}$ in. above the promenade deck. The centre one should be fitted 2.2 in. forward of station No 5 so that it comes almost under the forward edge of the base of the funnel; the others are located, one $5\frac{1}{2}$ in. forward and the other $5\frac{1}{2}$ in. aft of the centre one.

These beams, with the curved front and the parallel after portion of the cabin, make a firm base for the boatdeck. Before fitting it, however, it is necessary to provide support for the portions which overhang the cabins at the sides and aft.

On each side, amidships, where the boatdeck extends to the sides of the ship, there are four pillars to support it. In the ship these are channel irons about 8 in. wide, but in the model use strips of 16 s.w.g. brass $\frac{1}{8}$ in. wide $\times$ $1\frac{1}{2}$ in. long. Recesses must be cut in the deck planking at the positions shown on the profile in Fig. 38 and on Fig. 55, and the pillars soldered to the sideplates of the superstructure. The outer surface at the upper ends of these pillars must be tinned to receive the flange (Fig. 55) which will be soldered on later.

At the after end where the boatdeck overhangs the promenade deck six pillars are provided to support it. There is one at each side of the opening for the ladder to the shelter deck, one at each corner of the boatdeck and the remaining two at the angles made by cutting away the corners of the boatdeck. These will be seen in the photograph showing the after end of the superstructure in Part 10 (May 16).

They should be made of 14 s.w.g. brass wire $1\frac{1}{2}$ in. long. Recesses should be cut in the planking of the promenade deck to receive them and their lower ends soldered to the inside of the flange around the edge of the deck.

Finally the holes for the handrail stanchions should be drilled. About 14 will be required on each side, as will be seen from the profile on the general arrangement on page 96 (January 17), and across the after end a further five will be required. They should be a tight fit for the plug left on the end of the stanchion (*C*, Fig. 51, May 16). The stanchions and the rail can be fitted later, but it will be impossible to drill certain of the holes when the boatdeck is in position.

THE BOATDECK

The boatdeck should now be made, using tinplate 0.012 in. thick and cutting it to the shape shown in Fig. 38 (April 18). The opening for the ladders leading down to the promenade deck should be cut at this stage. The one aft measures 0.55 in. wide $\times$ 1.2 in. long. A vertical flange is fitted all round the inside so that it stands $\frac{1}{8}$ in. above the deck. The stanchions for the handrail which surrounds it on three sides are soldered to this flange. The position of the openings is shown in Fig. 38 (April 18) where it will be seen that it lies close to the after end of the cabin on the promenade deck and is set at an angle to suit the curve.

Similar openings must be cut in this deck on each side of the wheelhouse for the stairs which lead down to the outer dining saloon on the deck below. These openings should not be flanged at this stage as they require special treatment which will be explained later.

The baseplate for the funnel should be made and soldered to the boatdeck before fitting the deck in position. It is made of 16 s.w.g. brass sheet to the

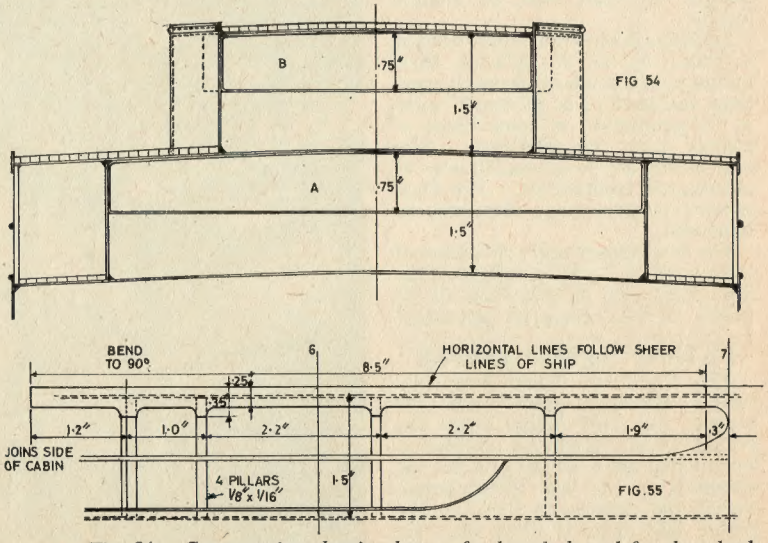


Fig. 54: Cross-section showing beams for boatdeck and for the wheelhouse top. Fig. 55: Details of flange and pillars and the boatdeck side

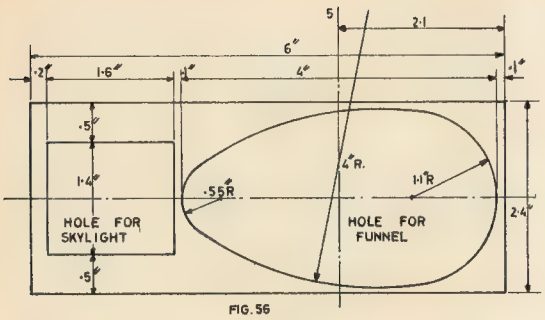


FIG. 56

Fig. 56: The baseplate for the funnel

Below, Fig. 57: Plan of wheelhouse and adjoining accommodation. Fig. 58: Details of windows and doors in the wheelhouse

dimensions shown in Fig. 56, with holes cut out to receive the funnel and engineroom skylight. Its forward edge is 2.1 in. forward of station 5 just aft of the wheelhouse as shown in the plan of the boatdeck in Fig. 38.

When it is soldered in place corresponding holes should be cut in the boatdeck. The edges of the holes should be finished flush with those in the baseplate. It will be found easier to fit the funnel to the exact rake if it is made a little too long and allowed to protrude on the underside of the deck. The deck should be checked for any distortion due to soldering on the thick plate and corrected if necessary.

An angle made of tinplate $\frac{1}{4}$ in. × $\frac{1}{4}$ in. × $\frac{1}{4}$ in. wide should be soldered on the centre line of the inside of the curved front to support the front end of the boatdeck.

The deck should be fitted carefully between the sides of the after portion of the promenade deck cabin and inside the curved front forward, making sure that it rests firmly on the transverse beams and on the pillars provided aft and amidships. Forward it must be fitted to the sweep of the wings of the bridge, at which point it rests on the projecting $\frac{1}{8}$ in. of the triangular pieces already fitted there.

The deck must now be tinned around the edges on the underside and at all places where it makes contact with the structure underneath. It can then be soldered in position. As it must be soldered from below certain of the joints are not very accessible, but the big opening in the promenade deck will give access to the joints inside the cabins. The joint with the slightly curved bulkhead aft can be soldered from outside, as a fillet of solder here will not be noticeable nor will it be in the way.

The curved space forward is completely enclosed, so the joint on the outer radius (i.e. with the inside of the curved front) must be soldered from above. If the top of the two triangular plates and the angle on the centre line have been properly tinned, heat applied from above should make a satisfactory joint. In this joint the

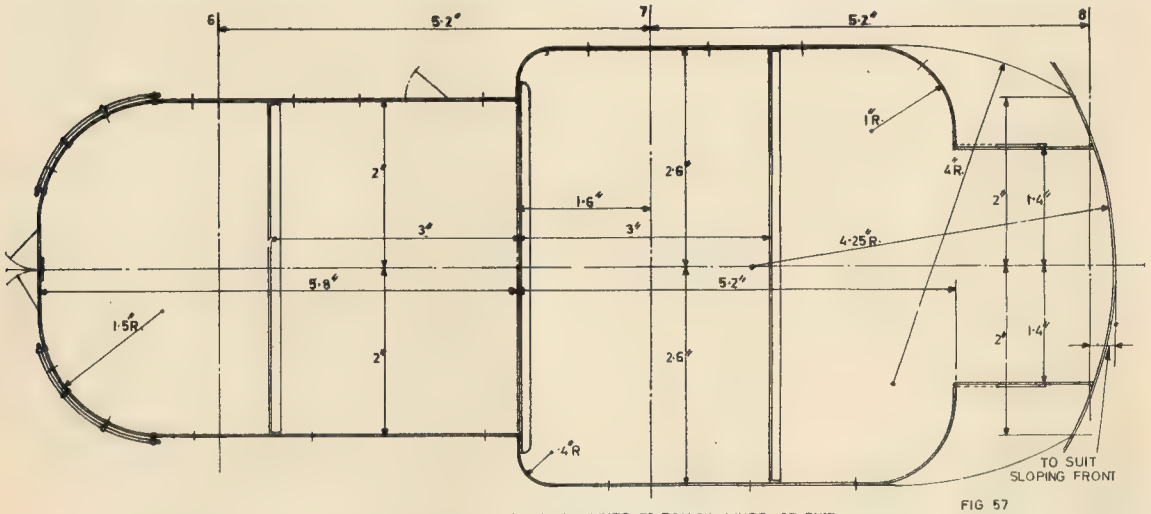


FIG 57

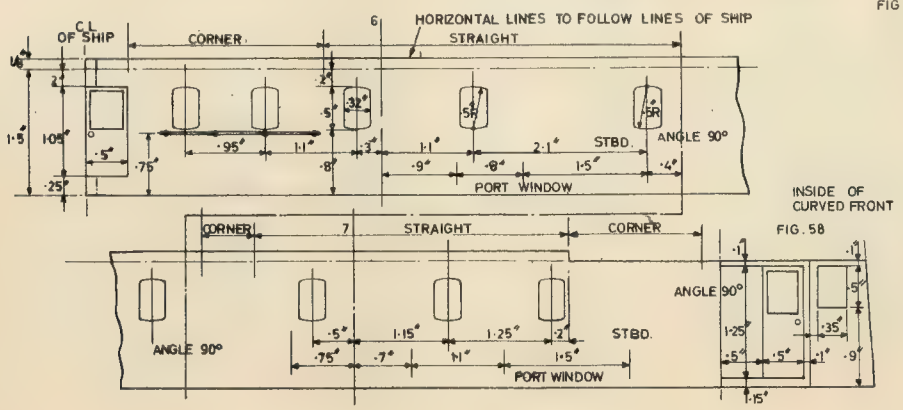


FIG. 58

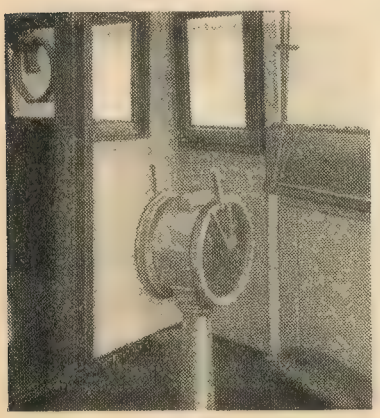
fillet of solder should be as small as possible so as to leave a clean corner for the deck planking.

The joint along the inner radius will, of course, be soldered from below through the opening in the promenade deck. At the two transverse bulkheads (Fig. 49, May 16) it should be possible with care to run a fillet of solder along their after sides. There will be a gap of about $\frac{1}{8}$ in. between the floor of the sidelight platforms and the deck, so a strip $\frac{3}{16}$ in. wide must be soldered along at each side to cover these.

The flange along the after edge of the boatdeck should now be fitted. It consists of a strip of tinplate $\frac{1}{4}$ in. wide, curved on its upper and lower edges to suit the camber of the deck (see Fig. 39, April 18). It is soldered along the after edge of the deck and the tops of the six pillars so that it projects $\frac{1}{8}$ in. above the deck. At each side it is continued forward until it meets the ends of the flanges on the sides of the deck at the curved corners of the promenade deck cabin. The joints here should be as clean as possible so that they give the effect of a continuous flange.

Next fit the flange along the overhanging edge of the deck amidships. These are cut from the heavier tinplate (0.012 in.) to the dimensions shown in Fig. 55, and soldered along the edge of the deck and along the tops of the brass pillars which are already in position. The forward end makes a butt joint with the projecting end of the superstructure at this point. It should be lined up accurately so that when cleaned up the joint will be invisible.

The after end is bent around the pillar and the corner of the deck and carried inboard until it meets the corresponding flange on the side of the cabin, to which it is then soldered.



Corner of bridge showing the wheelhouse doorway and the wind deflectors

THE WHEELHOUSE

The plan of the wheelhouse is shown in Fig. 57 which also gives the dimensions for making it. The sides should be made in two pieces, joined together with butt straps on the inside at the double doors in the after end. The position of the windows and doors is given in Fig. 58. In cutting out the strips for the sides, care must be taken to follow the curve of the deck, the sheer along the sides and the camber at the curved after end. The upper edge will be parallel with the lower throughout the entire length so that the roof, when fitted, will follow the lines of the ship.

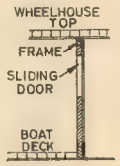


FIG. 59

Fig. 59: Section showing the sliding doors in wheelhouse

The double doors aft could be left open to aid realism and the sliding doors forward could be made to slide for the same reason. That is for the builder to decide and depends largely on what fittings, if any, are to be shown in the wheelhouse. A single door on the port side leads to the officers' quarters, which are located in the central portion of the house, but there is no corresponding door on the starboard side.

Having prepared the sides, they should be tinned on the upper and lower edges on the inside and soldered in position on the boatdeck, a good fillet of solder being run along the inside angle, leaving the outside angle clean and sharp so that there will be no difficulty when laying the deck planking.

Three beams for supporting the roof (see *B*, Fig. 54) should be fitted across the house in the positions shown in Fig. 57, the one below the mast being especially important. The forward and after beams are flanged along the top and sides and the centre one along the top only, as the sides of this one will be soldered flat along the steps in the sides of the house. The roof should be cut out and fitted in position. Around its after end, and forward to where it commences to overhang on each side the house below, it fits inside the side of the house and $\frac{1}{8}$ in. below its upper edge. Along its forward edge it fits inside the curved part of the superstructure and $\frac{1}{8}$ in. below its upper edge.

The roof must be tinned on the underside all round the edges and where it touches the bulkheads, after which it can be soldered in position, keeping the upper surface of the angle with the sides and front as clear of solder as possible. Make sure that it is in contact with the three transverse bulkheads so that there will be no chance of its buckling later.

Strips of tinplate $\frac{3}{16}$ in. wide must be soldered along the edge of the wheelhouse roof on each side where it is exposed, so that the upper edges are flush with the upper edges of the side and front. A length of half-round wire about 16 s.w.g. should be soldered all round the outside of this house, just below the upper edge, to form a beading. This should be of copper and left unpainted. It should be smooth but need not be polished as it will oxidise to a dark shade which will be very suitable.

Handrails are fitted on the rounded corners of the after end of this house at a level of 0.7 in. above the deck planking. They extend from the double doors to where the curve ends on each side, as shown in Fig. 57. They are of 20 s.w.g. brass wire and are supported by the brackets shown in Fig. 37 (April 4).

For those who wish to fit sliding doors to the wheelhouse I have shown a frame on three sides of the door in Fig. 58; this should be made of 16 s.w.g. brass and soldered on to the sides of the house. It would, of course, be easier to do this before bending the strip to the form of the house. The open side of the frame fits into the corner made by the wheelhouse itself and the wider house aft of it which contains the chart room and the officers' accommodation. This automatically forms a stop for the door when in the open position. The actual opening for the door should be 0.45 in. wide so that the door covers it when closed.

The door should also be made of 16 s.w.g. brass. To prevent its falling out the frame should be bevelled along the inside of the upper and lower members so that the narrower face is next the house. The top and bottom of the door should also be bevelled so that the upper edge slopes down and outward and the lower edge up and outward (see Fig. 59). The height of the door should be such that it slides freely when in position but that it will not fall out. To get it in it will be necessary to bend it outward in the middle, put it in, and then to flatten it with a tap from a hammer.

● *To be continued*

By Geometer

BEGINNER'S WORKSHOP

Machining double-web crankshafts

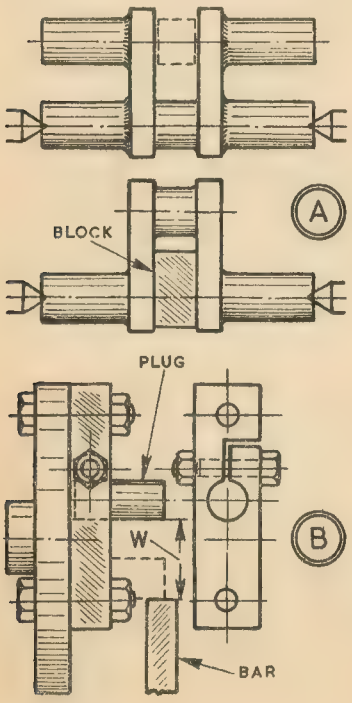
In setting-up methods, the choice for double-web crankshafts is somewhat larger than for single-web type, and the main influences in choice of a particular method are the construction adopted for the crankshaft, its size, and whether it has one crankpin, two, or several as in the case of a multi-cylinder engine.

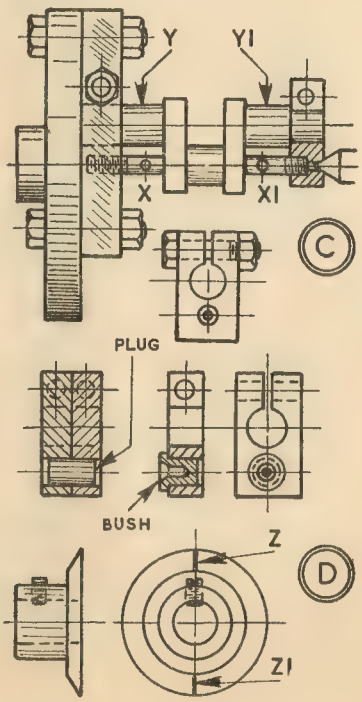
If the crankshaft is being machined from the solid, has only one crankpin and is modest in dimensions, a set-up can be made on an angleplate or a sub-faceplate as for a single-web crankshaft. The same is true if the crankshaft is a forging and not too large, the mainshafts being machined oversize for setting up to machine the crankpin, then afterwards finished to size.

Where there are two or more crankpins, however, the method alone is not in general applicable. It can be used for one end of the crankshaft, but the other must have support from the tailstock, which means there must be a "throw plate," either integral with the shaft, to be cut off afterwards, or clamped on for the particular machining operation.

With forethought, and assuming a brazed-up or welded-up construction to be acceptable, a single-cylinder crankshaft can be machined entirely between centres. The crankpin material is left as long as the mainshaft and both are centred, either before the building up process, or afterwards, locating the centres by marking off methods. With the mainshaft cut away between the webs, the crankpin is machined, as at *A* (upper diagram), then the mainshaft can be turned with a packing block between the webs (lower diagram).

For a double-web crankshaft not provided with setting-up features, throw plates can be used at each end and a set-up more speedily effected than on an angle-plate or a sub-faceplate. The throw plates each have a centre and are clamped to the mainshaft—so a set-up can be made between centres.





An improvement to this conventional arrangement, however, is to provide one throw plate with fixing holes to bolt to the faceplate, as at *B*—which ensures a powerful chatter-free drive on the intermittent cuts down the webs. Fixing holes are drilled in the bar material, then the mainshaft hole bored on centre, the material removed and the clamping bolthole drilled. Finally, saw cuts are made from the hole and the outside to meet.

To set the required throw, a plug is placed in the mainshaft hole, the lathe turned for the plug to touch a bar on the slide; then after rotating the lathe half-a-turn, a gauge of length *W*, the stroke of the engine, should fit between plug and bar. Adjustments are made until this condition obtains.

Previously, the crankshaft should have been prepared, also the throw plate for the tailstock end, except for the centre hole, and to drill this accurately the throw plate can be mounted on the plug in the main one.

To "push" on the tailstock reasonably for support, mainshaft ends may be stepped for throw plates, though with the present arrangement, the driving end will abut to the faceplate. If required, deflection can be avoided by tapping the plates and fitting studs, as at *C*, *X X1*, with drilled holes or filed flats as the means of turning.

General accuracy in making pairs of throw plates, or a second one, and also during the actual crankshaft machining can be enhanced by boring pairs plugged together, or the second one on a plug on the main one, then fitting a hardened silver-steel bush to the second one, as at *D*, to run on the tailstock centre.

For a multi-cylinder crankshaft, graduated collars can be fixed each end—points *Y Y1*, as at *C*. After machining a crankpin, shaft and collars can be turned in the throw plates to align for machining the next one. For a twin-cylinder crankshaft, collars would have two graduations, as at *D*, *Z Z1*. ▣

A collection of the most useful articles by Geometer has been issued in book form—*Workshop Hints and Tips*, published by Percival Marshall and Co. Ltd, price 3s. 6d. (postage 3d.), U.S. and Canada: $1.00.

Aids to efficient locomotive operation

H. J. TURPIN discusses some hints which are of help in servicing and maintaining model locomotives

I WAS DRAWN into the locomotive business in 1945 and attracted by the Ministry of Supply British Austerity as a type, not for its pleasing lines but for a sound sturdy design which could be produced in a $\frac{3}{4}$ in. scale model.

Zest was added to this project because it was about 1946 that the Chingford Model Engineering Club's track was being erected and the prospects of continuous running with child passengers was a great spur.

L.B.S.C.'s Austerity *Ada* in 2½ in. gauge, plus a half-inch scale drawing taken from *The Railway Gazette*, formed the basis of my design. As this progressed (on a 6 ft length of ply suspended from the picture rail in the dining room) I decided to make many departures in detail. So that is why my first locomotive was christened *Likeada*.

After four seasons of almost faultless service during which she travelled 336 miles I had formulated some very fixed ideas for a utility engine and trucks that would suit the conditions of running at Ridgeway Park where one has to drive the whole way round. The outcome of this was *Hybrid*, described in MODEL ENGINEER for 12 January 1956. This engine went on to complete 1,000 miles of running in a further five years and its work only came to an end due to the owner's health.

Both engines are not now in my possession but I know, however, that they are in good hands and will still give a good account of themselves.

In these notes I have described some of the satisfactory features that were embodied in these engines and the reasons for their use.

★

IN considering the reversing lever designs at the time of scheming out *Likeada* there were two systems to choose from—the notched arc and lever, and the screw and wheel. I chose the former because it was more accessible and quicker in operation.

This proved very satisfactory, but as time went on (and sometimes we had four trains running continuously on the track at Ridgeway Park, Chingford) I could see that everything had to be done in future to reduce the time required in operating all features of the engine—hence *Hybrid*. And one of the conspicuous features in *Hybrid's* success is the friction controlled reversing lever. It is instantaneous in action and cuts out fumbling for small catches and wheels.

Fig. 2 shows the arrangement. The lever itself is in two parts—a cylindrical member 2 in. dia. × $\frac{3}{8}$ in. thick on to which is silver soldered the handle proper. It is fixed to a $\frac{3}{8}$ in. dia. cross-shaft at each end of which is a reach-rod crank adjustable for position.

The lever revolves around a disc which is fixed to the sideplate by two screws and distance pieces. Friction lining is a disc cut from a postcard and has never been changed or examined over five running seasons. Spring pressure is applied by a spring ring bent in one plane as shown and fixed to the rotating member by two screws *A*. Only the top third of the cylindrical member is visible above the runningboard.

★

WHEN *Hybrid* was first steamed she was a very wet engine and primed freely when drawing away after a stop at the station.

On thinking this over I came to the conclusion that the fault lay in the fact that the cylinders were in intimate contact with the sideplates causing the whole frame to function as a great sink into which heat from the cylinders flowed.

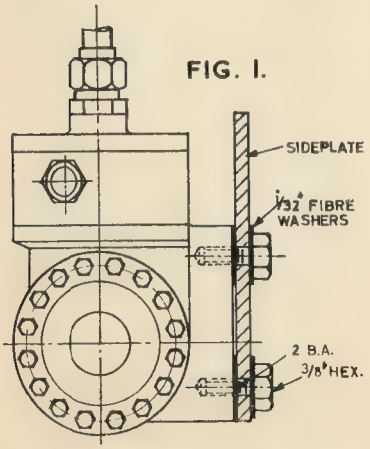
The answer was to insulate one from the other. Fig. 1 shows the remedy—1/32 in. fibre washers between these two members and also under the heads of the fixing screws. Each washer was clamped separately in a smooth-jaw vice before assembly to remove all the set. The resulting thickness being about 0.025 in. and a really hard washer.

These washers plus the fitting of steam operated drains made the effects of priming negligible.

★

FIRST glance at the design of the sight-feed lubricator is that it is somewhat involved. In a sense it is so, but it was developed piece by piece over a whole running season, and continued in its completed form for a further three seasons without any fault whatever.

FIG. I.



Left: Method of insulating the cylinders from the main frame

Right: Details of the friction controlled reversing lever

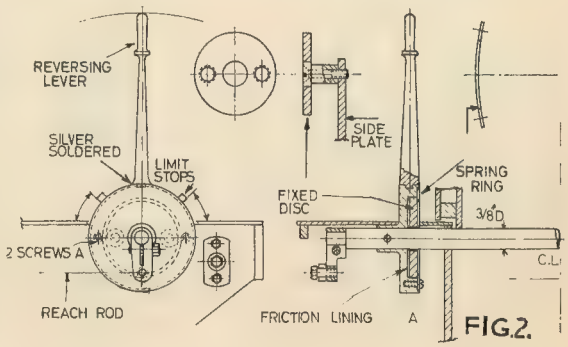


FIG.2.

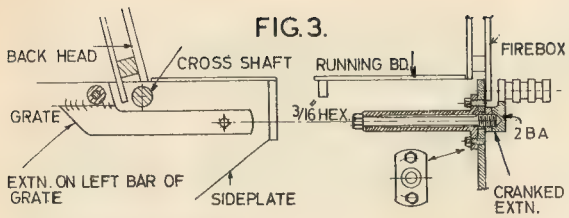


FIG. 3.

Left: Means of providing easy access to grate

Right: Drive for a sight-feed lubricator unit

Below: Constructional details of the lubricator

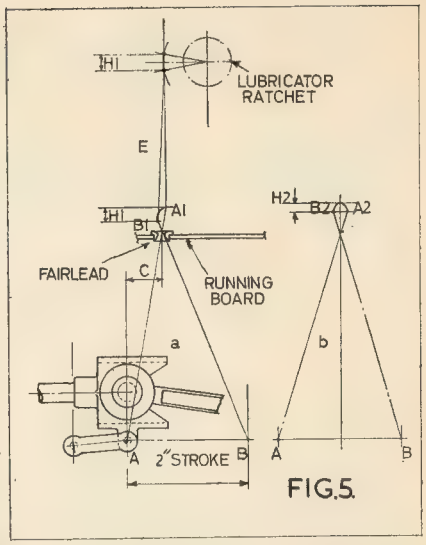


FIG. 5.

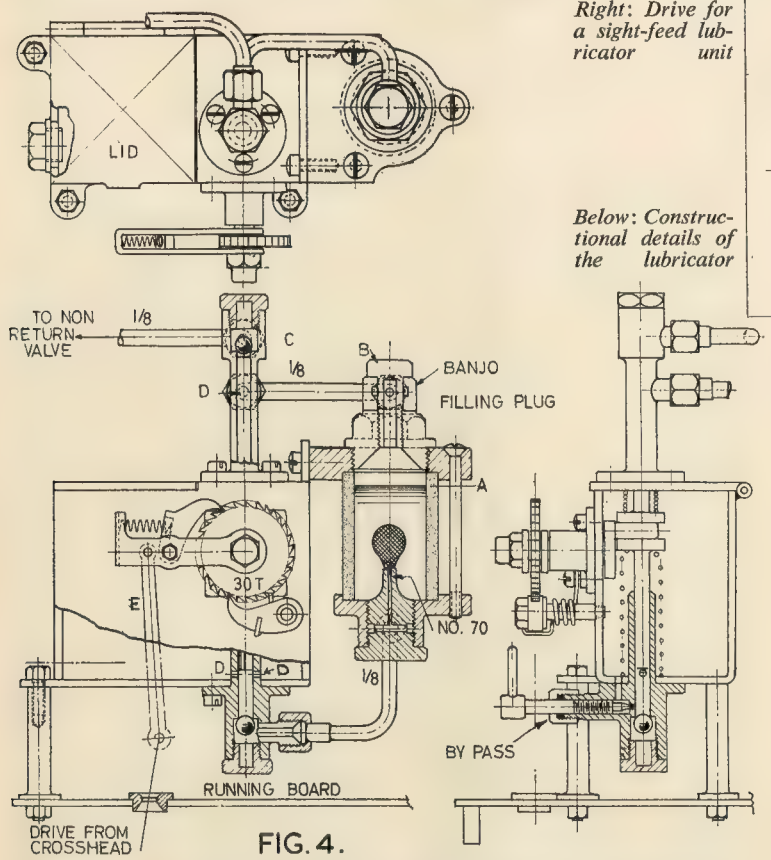


FIG. 4.

There are two pumps operating from one crankpin by the usual type of ratchet gear. The lower pump forces oil through the nozzle to form a bead, about $\frac{1}{4}$ in. dia. × $\frac{3}{8}$ in. high, which breaks off and slowly rises to the top of the brine. The upper pump draws oil from the top of the glass and discharges it via valve *C* to the oil main.

A bead of oil is only able to rise if it has a lower specific gravity than the surrounding medium. As the s.g. of water is one and that of oil only slightly less, salt is added to the water to increase its s.g. (I use one flat teaspoonful to a wineglass measure of water).

For simplicity this pump is fitted only with delivery valves and, therefore, oil has to be drawn in through 0.08 in. holes *D* in the cylinder walls at the end of the stroke. A bypass is provided at the lower pump to adjust the desired delivery. On *Hybrid*, a 5 in. gauge passenger hauling engine, I found one bead per 100 yd ample lubrication.

Pumps are $\frac{1}{8}$ in. dia. and have an actual stroke of $\frac{5}{16}$ in. but the effective stroke is the diameter of the inlet holes less than this, viz. 0.23 in.

The reason for plunger pumps is that they never wear out as there are no contacting surfaces under pressure; but it is essential to produce a smooth fit without shake between piston and cylinder. Both components should be lapped.

The glass is $\frac{3}{4}$ in. o.d., $\frac{9}{16}$ in. i.d. × 1 in. long, ground square and flat each end (I had a few made by a local laboratory equipment company), sealed with gold size while being clamped between the top and bottom members with three 6 B.A. screws. There is never any need to break this seal because removal of the filling plug and jet enable the glass to be thoroughly cleaned and filled.

The drive has been described to me by onlookers at Ridgeway Park as a curiosity. Figs 4 and 5 show how this is obtained. A link of 3/32 in. rod is attached to the crosshead at *A*, taken up through a fairlead in the runningboard and connected to the ratchet link *E* at *A*1.

If the fairlead is vertically over the mid point in the stroke *AB*, see (*b*), then for one stroke *A* to *B* the path of the link at the upper end is from *A*2 to *B*2 which produces an up and down distance *H*2 to operate the ratchet. This is repeated in the reverse direction as the crosshead returns from *B* to *A*. Hence the ratchet would be operated *twice* for every revolution of the driving wheels.

On the other hand, by moving the fairlead to an offset distance *C* the path of the upper end of the link travels from *A*1 to *B*1—a height *H*1 for one stroke of the crosshead. On the return stroke the path is from *B*1 to *A*1, thus operating the ratchet only *once* per revolution which is what is required.

★

DROPPING the fire can be controlled safely and quickly by an extension to the left bar of the grate (Fig. 3). At the rear end this is supported by a No 2 B.A. captive screw carried in a bracket attached to the sideplate. With a $\frac{3}{16}$ in. hexagon box spanner the screw can be withdrawn and the grate operated by hand by gripping the relatively cool extension. It is one of those worthwhile fittings. ▣

The MUNCASTER steam-engine models — 8

Continued from 16 May 1957, pages 700 to 702

In this instalment EDGAR T. WESTBURY discusses governors and control gear

SEVERAL of the engine designs in this series have included governor gear, which is a necessary fitting for engines which have to maintain a fairly constant speed under varying load conditions and, in fact, practically any engine which is not under the constant supervision of the driver.

Nearly all steam-engine governors are of the centrifugal type, based on the original pendulum governor of James Watt, and, in the earlier engines at least, were usually made as a self-contained unit, located at a convenient position on the engine to be driven by belt or gears, and for connecting up to a throttle control valve. I have described governor mechanism in connection with the Unicorn and Tangye engines as well as in a separate article [MODEL ENGINEER, 27 October 1955] dealing with a governor unit suitable for the Vulcan beam engine or other early types.

Although the basic principle of the governor is very easy to grasp—indeed, it is obvious to anyone who has observed the forces exerted in rotating masses—a full explanation of the theoretical considerations involved in its design would take up far more space than could be spared here. Advanced text books on mechanics usually devote one or two pages of mathematical formulae to the phenomena of centrifugal force (for example, see Ganot's *Physics*, para. 55), but I propose to deal only with simple practical applications of the governor in the examples illustrated by Muncaster.

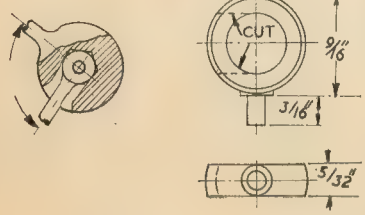
As first designed by James Watt, the rotating ball weights of the governor not only produced the positive operating effort, under the effect of centrifugal force, but also the negative or restoring effort, under the effect of gravity; no extra weights or springs were used, and the vertical shaft arrangement was essential for its operation. Muncaster states that in this form it cannot be recommended for small engines, and my own experience supports this view; the reason of course is that in a small size, the gravitational effect is reduced to a much greater extent than the friction in the working parts.

The action of a governor relying on the weight of the balls alone to restore the control on reduction of speed would be very erratic or "sticky." Some governors, such as the Porter type, have an additional moving weight, which slides on the centre shaft and supplements the restoring force, but even this is limited in its effects and has been found inadequate in small sizes. It is also necessary in most cases to increase the positive effort by running small governors at higher speed than the full-size types.

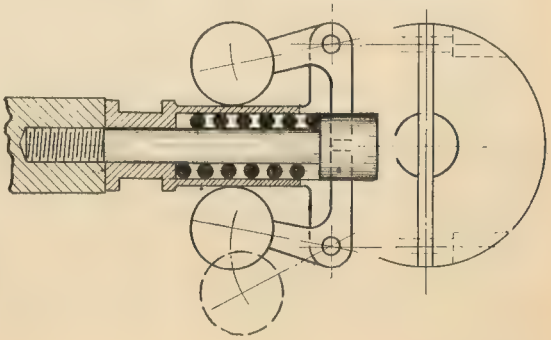
The obvious method of increasing the restoring effort is by fitting some kind of spring. In theory, this complicates matters because there is a definite difference between the action of a spring and that of gravity, but in practice governors fitted with springs work quite well. The governor illustrated in Fig. 38 has a compression spring fitted on the centre shaft, which exerts pressure between the fixed upper yoke from which the weight arms are suspended, and the lower sliding yoke carrying the grooved collar which operates the control lever.

This design has several features in common with the governor of the Tangye engine previously referred to, but the method of articulating the links is somewhat different. Instead of forking the top ends to embrace the ball, the latter is made hollow and the link is made ball-ended to fit inside it; in either case the pivot pin passes diametrically through the centre of the ball. This is a very neat arrangement, but it decreases the weight of the ball substantially so that it must be made larger to produce the same centrifugal effect.

To transmit the movement of the sliding yoke to the governor lever with the minimum friction, a horse-shoe-shaped thrust collar is fitted to the groove, with extended pivots engaging the eyes of short arms which straddle the yoke and are pinned to the lever shaft. These details are illustrated in Fig. 39. The governor shaft runs in a long vertical bearing, in a bracket mounted on the engine frame, and is bevel-geared to the



Left, Fig. 39: Details of the link pivots and thrust collar for the vertical-shaft governor



Right, Fig. 40: A horizontal spring-loaded governor suitable for high-speed engines

drive shaft which runs in a long horizontal bearing.

For high-speed engines, such as those used for driving electrical generators, it is often found convenient to fit the governor directly on the end of the main shaft, thus avoiding the necessity for either belt or gear drive, and making a compact arrangement. In this case spring return is an obvious necessity, and it is also desirable to reduce the number of working parts in the mechanism, thus cutting down wear, friction and any tendency to rattle. The governor (Fig. 40) fulfils these conditions, as it entails the use of only two pivoted joints and a single sliding member, with a totally-enclosed central compression spring. This type is suitable for the engine shown in Fig. 28.

It will be seen that as the balls move outwards under the effect of centrifugal force, the bell crank levers to which they are attached press against a fixed thrust washer, causing the entire governor assembly to move bodily to the left. The grooved collar on the sleeve operates the governor lever through a thrust collar, as in the previous example, though this is not shown. In the drawing, the shaft extension which carries the governor is shown as screwed into the end of the main engine shaft, but there are practical objections to this arrangement, and I would suggest modifying it.

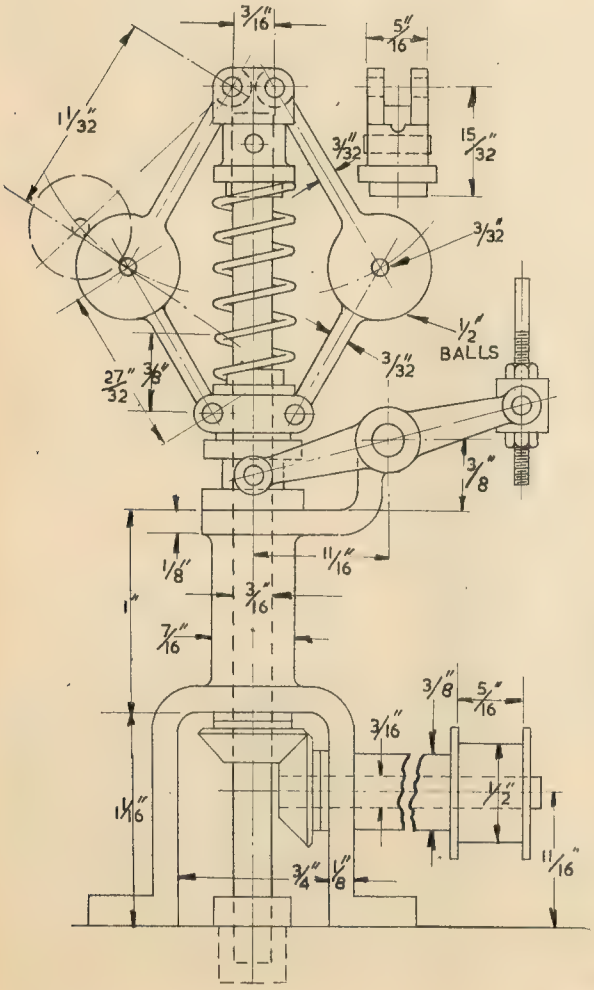
Apart from the risk of the extension unscrewing if the shaft ran in a clockwise direction or in the event of sudden acceleration or stopping, there might be difficulty in ensuring true running of the extension shaft. It would be better to make this integral with the shaft or devise some more positive scheme of fixing and alignment.

It is hardly necessary to add that the governor assembly should be symmetrical and in balance at all speeds; this is of special importance not only when it is fitted on a shaft extension as in this case, but also where it projects a long way above a single vertical bearing as in the previous example.

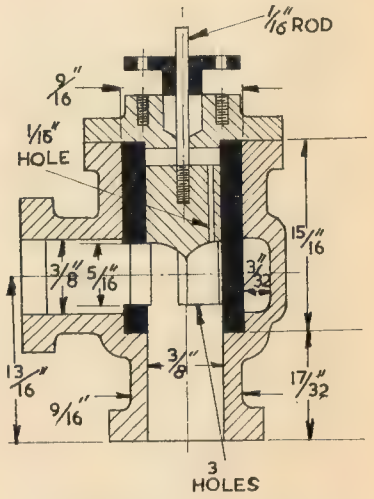
THROTTLE VALVES

The design of the control gear which regulates engine speed under the influence of the governor is of equal importance to that of the governor itself. The simplest method of governing is by means of a throttle or restricting valve, which may be of any type so long as it is capable of being operated with the minimum effort; it does not need to be capable of shutting completely, as it is generally a supplement to the main engine stop-valve, which should be quite steamtight when closed.

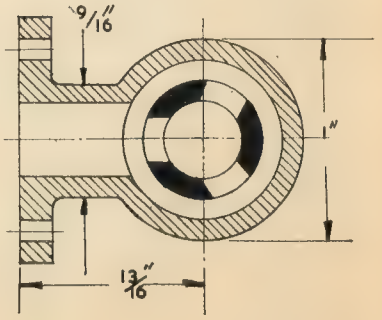
The type of throttle valve shown in Fig. 41 is commonly used in full-size practice and is recommended by



Left, Fig. 38: A spring-loaded vertical-shaft governor, bevel-geared for belt or direct drive



Right, Fig. 41: Details of the sliding piston-type throttle valve for governor control



MUNCASTER MODELS . . .

Muncaster for small engines. It is similar to that specified for the Tangye engine, but I have found it more difficult to employ successfully than types which have a rotary movement, such as barrel or butterfly valves. The reason for this is that it takes less effort to rotate a shaft in a packed gland than to slide it bodily through the gland, as in this case.

However, the example illustrated is certainly capable of working successfully on the larger models for which it is obviously intended, having a bore diameter of $\frac{3}{8}$ in. Steam must be admitted from the left-hand (horizontal) branch, the vertical passage being connected to the engine. It is fitted with a liner having three ports which open into an annular passage, so that pressure is even all round the valve and there is no tendency to press it against one side of the liner. The sliding piston should be a smooth, easy fit in the liner, the two parts preferably being of dissimilar metals, such as steel and cast iron, or brass and hard bronze, to give good wearing properties. A hole must be drilled through the piston to balance the pressure on the upper surface, otherwise it will be difficult to move owing to inequalities in this respect or through the trapping of steam or water. Care must be taken to fit the cover, with its central gland, in exact concentric register with the liner, and the piston and rod also concentric with each other.

GOVERNOR CONTROLLING POWER

The " power " of a governor may be defined as the positive effort which it is capable of exerting on the control valve. It must obviously be capable of overcoming any frictional or other resistance encountered in the control gear, and it is desirable to have a margin of power in hand to ensure reliable action. The power can be increased in two ways: by increasing the weight of the balls, and by increasing the rotational speed. Large slow-speed engines call for heavy governor weights unless the governor is geared up. But in high-speed engines a governor which appears much too small may be just as effective.

It should be noted that the force available to operate the control gear is influenced by the means by which motion is transmitted from the governor. Sometimes, in order to obtain sufficient amplitude of movement at the valve rod or spindle from a relatively small governor movement, multiplying levers are used in the connecting mechanism, and the effective force is, therefore, reduced in inverse ratio to the increased movement. Thus the governor power must be adequate to cope with this.

If, however, either the effective weight or speed of a governor is increased, it will come into operation at a lower speed and thus, if the engine speed is to remain the same, equilibrium must be restored by increasing the strength of the return spring or counterweight. Erratic action or " hunting " (alternate rise and fall of engine speed) may be caused by friction in the control gear or by faulty governor design—this includes too great a multiplication of lever movement—so that the control valve moves over too great a range with a slight increase of speed. Steadiness of control is sometimes improved by fitting a damping device, such as an air or liquid dashpot. Speed range can be adjusted by varying the spring tension, or fitting an external spring which can be adjusted while running.

ACCURACY OF CONTROL

Although a governor is often assumed to be capable of keeping the engine speed exactly constant, this is not so in practice because the governor cannot effect any change in the throttle position until some change of speed has taken place. There must obviously be some margin of error in any type of governor, depending on its design and control linkage, but more still on workmanship and elimination of friction. For most stationary engines of small size, a margin of five per cent. deviation from the set speed is fairly reasonable, but for special purposes, such as generating electricity, closer accuracy is necessary, and the permissible variation may be less than one per cent. in some cases.

Geared or positively-coupled governors are preferred for accurate control, as belt-driven governors may be liable to variable slip—and their reliability may be open to question. Cases have occurred where broken governor belts have caused serious accidents, sometimes with loss of life. Nevertheless belt driven governors gave good results on steam-engines for many years.

EXPANSION GOVERNORS

While throttle governing is effective, and is probably the most satisfactory method on small engines where rigid steam economy is not the first consideration, it tends to waste steam by the wiredrawing effect of the throttle valve, which results in lowering the working pressure of the steam before it enters the engine cylinder. To obtain the best efficiency the steam should be admitted at full pressure, but cut off earlier in the piston stroke so that it can be used expansively and its energy utilised to the best effect. This is done in most large engines by using governors which vary the timing of the valve gear.

The governors themselves may be of normal type though they are sometimes of special design; they may operate on the normal slide or piston valve through linkage comparable to that of reversing gear, or on " trick " valves with elaborate porting arrangements. Corliss and drop-valve engines have trip devices which close the steam admission valve suddenly at different cut-off points under governor control.

A very simple and effective expansion governor is that fitted directly on the engine shaft—often in the flywheel—and controlling a movable eccentric, not only by reducing the throw but also advancing the timing. If only the throw and, consequently, the valve travel were reduced, it would certainly result in earlier cut-off of steam, and, therefore, be effective in speed control; but it would be uneconomical because the admission point would be retarded or, in other words, lead reduced in the same proportion. To compensate for this, therefore, the eccentric is advanced as its stroke is reduced.

As expansion governors are a specialised type in which only a limited number of readers are likely to be interested, I do not propose to describe them further. But for the benefit of those seeking further information, it may be noted that they were fully dealt with by Muncaster in a series of articles in Vol. XXVI (January to June 1912) of MODEL ENGINEER.

● *To be concluded*

SMALLEST AMATEUR WIRELESS SET IN THE WORLD

A FULL constructional feature on how to build a transistor wireless which is claimed to be the smallest amateur set in the world is given in the current issue of *Home Mechanics*. Including battery and aerial, the set is no larger than a packet of 10 cigarettes. It has an earpiece from a deaf-aid set and is an extremely fine design, capable of receiving the Home, Light and Third programmes.

There are many other articles of outstanding interest to home craftsmen in the same issue, which is on sale at allbookstalls and newsagents, price 1s. 3d. Place a regular order for *Home Mechanics* without delay.

If there is difficulty about obtaining a copy, send a postal order for 1s. 6d. (including postage) to Sales Department, Percival Marshall and Co. Ltd, 19-20 Noel Street, London, W.1.

Reaction testing device

C. R. JAMES recalls a war-time invention that aided the R.A.F.

DURING the last war I spent some time conducting experiments in the variation of reaction time of pilots from the moment of their seeing a target in the sights to pressing the button to fire their guns.

I realised that a pilot's reactions combined with deflections—due to high speeds—of his aircraft could result in failure to hit the target. Thus, if sufficient tests could be made, the time-lag average could be ascertained and suitable adjustments made to the sights. I thereupon set about making a device in an attempt to find the average reaction time.

A gramophone motor driving a turntable at the fixed speed of 78 r.p.m. was obtained. A circular scale, having divisions to read 1/100 sec., was prepared and attached to the turntable and a small knob was fixed opposite the zero mark on the scale near the outside edge of the turntable.

A light spring arm, to which was attached the moving arm of a car contact breaker, was placed on a small platform, so that the knob would stroke the spring and actuate the make and break each revolution. A fine pointer was located over the scale.

Electric bulbs were next fixed in a circuit with the contact breaker in series, two bulbs wired with flex were placed on a portable platform at a suitable distance from the person being tested, and a silently-operated switch enabled the operator to change the bulb in circuit at any time, thus changing the flashing light from one bulb to the other.

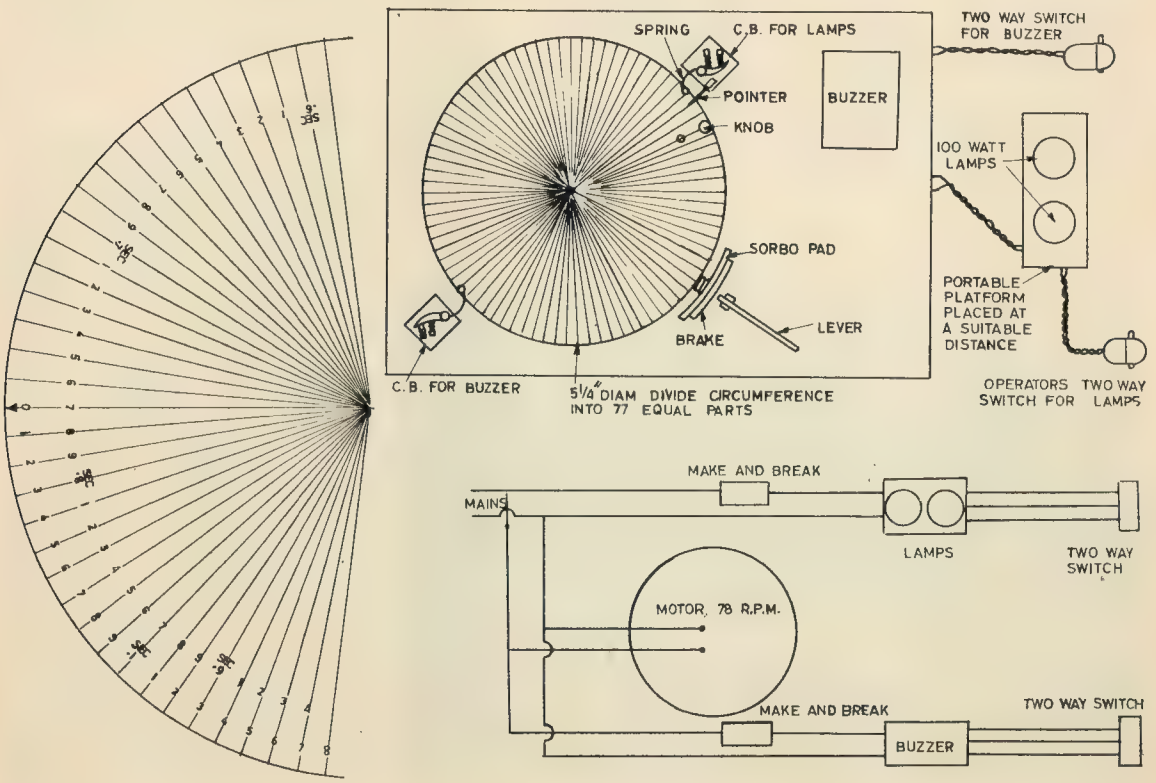
The person being tested was invited to depress a small lever immediately the flashing light changed from one bulb to the other. The lever when pressed operated a strong brake on to the turntable edge, *stopping it instantly.*

It was obvious that from the moment the person saw the light appear in the non-flashing bulb to the time the turntable stopped, the distance the turntable had travelled had automatically measured the time reaction. The divisions indicated hundredths of a second, but at the outer edge they were approximately $\frac{1}{8}$ in. wide—so it would have been possible to further calibrate to a finer degree.

Commander came top

The device was shown to an R.A.F. medical officer at a local fighter squadron station. He used it for about 12 months, during which time he tested hundreds of personnel. I understood that the test was included to obtain data for service requirements. It is interesting to note that the person whose reaction was the fastest was the station commander, who had a time of less than a quarter of a second !

By attaching a further spring and contact breaker (which in turn was wired to two different note buzzers that could be heard in the headphones) an inter-comm could be introduced to discover possible effects it could have on sight reaction. The reaction to change of sound could also be timed separately, if desired. ■



50 years ago

What queries did readers of "Model Engineer" ask half a century ago? A glance through the 1907 volume shows a varied assortment

FIFTY YEARS AGO the queries rolled in to MODEL ENGINEER —queries concerned with almost every kind of engineering, with mathematics and chemistry and with electricity in every possible application including the new science of radio.

It was noticed that at certain times the number grew. At these times more readers had questions to ask and invariably many of their questions were alike. Why should dozens of people in different parts of Britain want precisely the same rather unlikely information at precisely the same time?

Sherlock Holmes had returned to Baker Street after the unfortunate affair at the Upper Reichenbach Falls, but the Queries Department succeeded in solving the mystery without consulting him. The phenomenon, it was noted, became most marked in March and April; and May was the time when the Board of Education and the City and Guilds of London Institute held their examinations!

People who are studying for an important examination like, of course, to read the papers set in previous years and to know the answers to the questions which were then asked, partly because they give the best possible idea of what can be expected and partly because certain themes tend to recur.

In the bonnets of all examiners in a particular subject the same bees go on buzzing year after year, and it was with the hope of catching some of these bees that the prospective examinees wrote to MODEL ENGINEER. Their questions were examination posers from the past.

"Evidently many of our readers," said an editorial in April 1907, "are preparing for the forthcoming examinations in May, and are anxious for our help in coaching them up. Sometimes they are frank in their requests, and state that their questions are for examination purposes; but in others the problems are merely submitted as ordinary queries, though it is not a difficult matter for us to appraise them at their true value.

"We should like to take this opportunity of saying that we regard all examination questions as being beyond the proper scope of our Query and Replies column, and we cannot undertake to reply to them through this channel.

"The majority of readers who are preparing for the examination in question are attending regular classes in the subjects they are studying, and they should apply to their teachers for the help and explanations they require. Even if they are not attending classes, there are many suitable textbooks published in which selected examination questions are given and answered, and these should suffice for all requirements.

"One recent correspondent in a remote Irish town who desired help of this kind asked us if we could not possibly supply him with a complete set of questions and answers for the forthcoming examinations, for, as he naïvely suggested, the examinations would surely be held in London before they were held in his own town!"

Fifty years later we are amused—but there are still examinee readers who try to use the Technical Queries Department of MODEL ENGINEER as a correspondence school. Irishmen who want the next official questions and answers in advance are, however, rarer than they were.

Quick-fire querist

Some of the querists, even those without an examination to darken the sunshine of May, were determined to have their money's worth when they enclosed the stamped addressed envelope. T.G.G.B. was one among many who fired off questions like the Maxim gun, which had then been in use for 10 years:

"Could you enlighten me on the following points, (1) What is the proper voltage for charging a 4-volt accumulator? Will 6 volts do? Mine has to be charged at 0.5 amps and my dynamo gives 2.5 amps. What resistance is necessary? (2) Could you send me a sketch of a switch by which a 4-volt or a 2-volt accumulator can be connected to a lamp? (3) Is the Hellesen dry battery suitable for lighting? (4) Could you let me know of one or two books on Electric Batteries and their prices? (5) What are "Osram" lamps made of? (6) Can you tell me of a firm who sell 4-volt tantalum or Nernst lamps? (7) In accumulators, what is the ratio of amp-hours to area of plate? Does this mean all the plates? Does it mean both sides? (8) In an accumulator why do they have more positive

Some of the members and boats of the Victoria Model Steamboat Club

than negative plates ? (9) Could you tell me the sort of reflector to use with a 4-volt lamp in order to send out a diverging beam of light which at a distance of 2 ft. from a wall would give a circle of light about 14 ins. diameter ? My diagram will perhaps explain what I mean. I intend the whole to be about the size of a cycle lantern with a lens in front, mounted in a piece of wood for reading by. What shape and size reflector should I use ? What size lens ? (10) How long ought a 5 amp-hour accumulator to be charged for ? Must it be charged for, say, twelve hours consecutively ? (11) Where can I obtain small Edison Lélande cells ? (12) Is there any way of telling (without a speed meter) if my dynamo is running at 3,000 revolutions per minute ? "

The Queries Department took a deep breath and answered the whole round dozen.

No smoke, no sparks

In that same month, Charles S. Lake described a compressed air locomotive whose great advantage was the entire absence of smoke, sparks and fire.

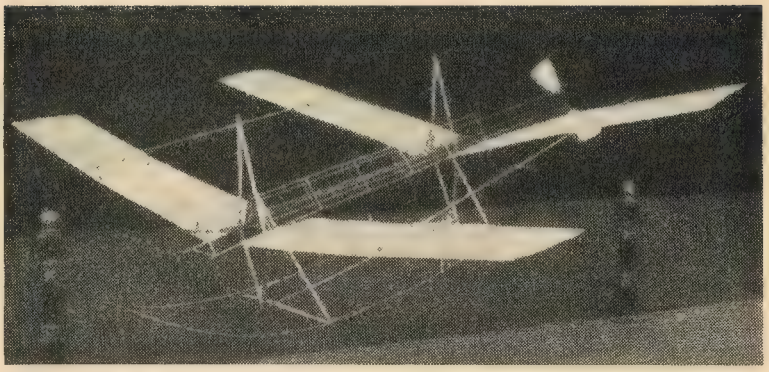
" The place of the boiler in an ordinary locomotive," he wrote, " is taken by a cylindrical storage tank mounted above and supported by two frames in the ordinary manner. The cylinders and other parts of the engine are arranged much as usual, the wheels being coupled together by side rods, and valve and reversing gears being applied as is customary in steam locomotives.

" For underground purposes the air is compressed by stationary plant above ground, and is conveyed through specially strong piping to the head of the shaft and thence to the charging stations below.

" The locomotives come to these stations to have their tanks charged in the same way as ordinary coaling locomotives have to go to the coaling stage for a supply of fuel, and to the water crane for water. The charging operation is very quickly performed, occupying from one to two minutes, according to the size of the locomotive tank.

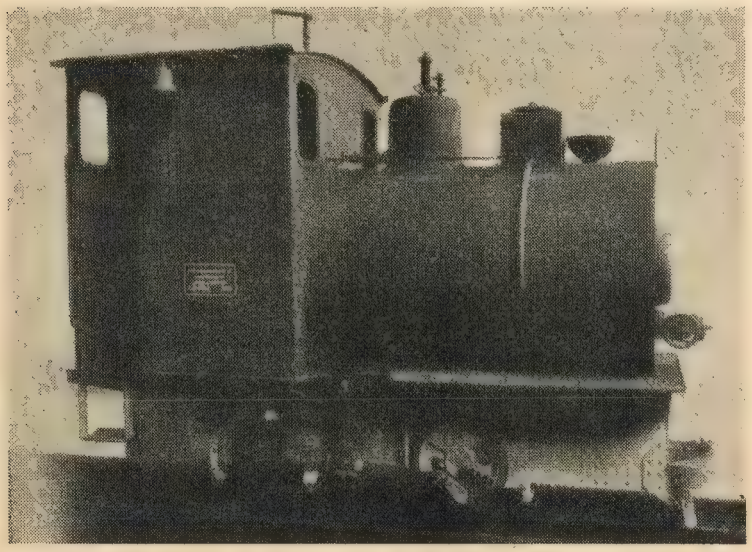
" The latter is fitted with safety valves, and a sandbox is also mounted upon it. The compressed air passes from the tank to the cylinders through a reducing valve, and is controlled by a regulator valve with handle in the cab, as in the ordinary arrangement for controlling the supply of steam to the cylinders in steam locomotives."

In the example illustrated, an engine built by the Hannover'sche Maschinenbeau Aktiengesellschaft, the air was distributed to the cylinders by a modified form of Walschaert's valve-gearing. It was no doubt a very useful engine but no one would have called it elegant and for that reason we may be glad to know that it lived entirely underground.



Model of a Langley-type aeroplane made by the famous A. V. Roe in 1907

Compressed-air locomotive for working in mines



Ladies of the Lake

Some years earlier a number of steamboat modellers otherwise unknown to each other had been meeting frequently at the Victoria Park Lake in London. " It stands to reason," declared a writer in MODEL ENGINEER, " that you cannot alter the pitch of the propeller of a man's boat, borrow his last drop of benzoline and use up all his matches without getting to know him "; and so, in July 1904, the Victoria Model Steamboat Club was formed.

By 1907 the V.M.S.C. was performing on Saturday afternoons in summer before an enormous public of small boys (" What's it go by, mister ? ") and on Sunday mornings before a wall of charming young ladies. It always took longer to get up steam on Sunday mornings. There were also meetings indoors, in a classroom lent by the Reverend Neville Dundas, vicar of Holy Trinity, Stepney, who was an honorary member. James C. Crebbin, the club president, began by showing the members (they paid a shilling a quarter) what could be done with model locomotives and in that way encouraged them to " go and do likewise with model boats."

Mr Crebbin, afterwards known as Uncle Jim, went on to become one of the best-known personalities in model engineering.

An idea is born

From the issue of 30 May 1907:

" As the result of suggestions both from private readers and from members of the trade, we have been induced to consider the possibility of organising a Model Engineering Exhibition." ■

LOCOMOTIVES I HAVE KNOWN

Number 34 by J. N. Maskelyne

IT WAS in the summer of 1901 that a younger brother and I were taken by our nurse to spend a fortnight's holiday at the then almost unknown, and decidedly remote, Norfolk village of Blakeney.

It was my first journey on the old Great Eastern main line (I have already written about my first meeting with G.E.R. No 1 [Article No 20 *ante*], which occurred during this same journey) and I vividly recall catching sight of No 1900, *Claud Hamilton*, as we slowly drew out of Liverpool Street station.

Here was a noble engine, if ever there were one; I had read about her in the *Locomotive Magazine* not long before and learned that she had been an exhibit at the Paris Exhibition the previous year. That fact was plain to see in the engine herself, for she retained that true "exhibition finish" which her cleaners bestowed upon her for some years afterwards and made her a rewarding sight for locomotive enthusiasts; and in those days it was *some* finish, the art of attaining which has long since been forgotten.

Claud Hamilton was the first of a class of no fewer than 111 fine 4-4-0 express passenger engines designed by James Holden for working the principal express trains of the Great Eastern Railway, and these splendid engines were destined to become known all over the world for the outstanding quality of their performances.

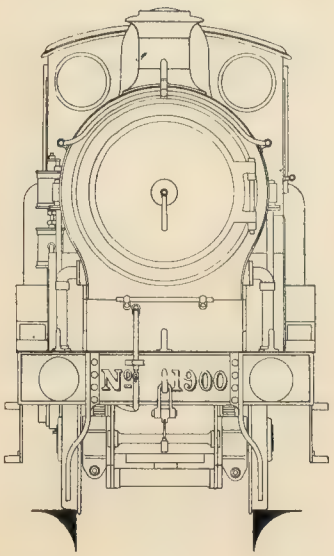
Stationed at Stratford, Ipswich and Norwich, handled by enginemen whose names are remembered and whose deeds are recalled to this day, these engines were literally the pride of the line for several years. In fact, it was not until 1911 that they were displaced by a 4-6-0 type, 1500 class, on the heaviest trains. A Claud at the head of the 400 ton *Norfolk Coast Express*, climbing the Brentwood bank, provided spectacle and sound effects that can never be forgotten.

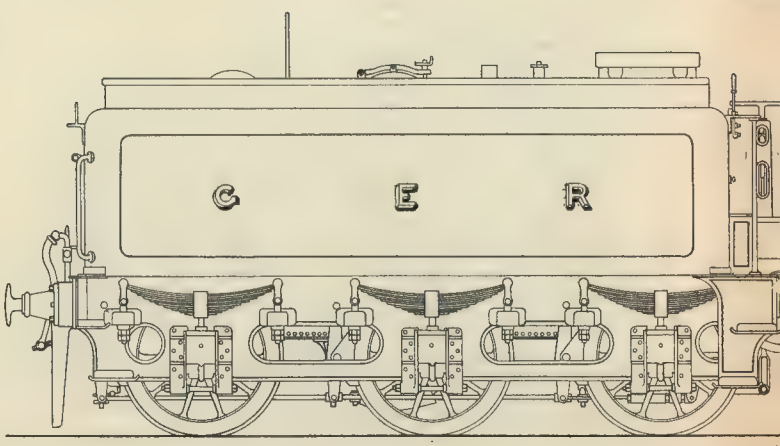
The dimensions of these engines were fully abreast of the prevailing practice, and certain changes and improvements were introduced, almost from batch to batch, as the engines were built. The numbering was peculiar in that it progressed backwards: the first 10 were 1900 to 1891; the next 1890 to 1881, and so on to the last one, which was No 1791. *Claud Hamilton* was the only one to have a name, a distinction it shared with only two other G.E.R. locomotives.

The reason for the retrograde progress of the numbers was: the number 1900 had been chosen to mark the year in which the engine was built as well as the fact that she was exhibited at the Paris Exhibition in that year, and the number was nearly 800 above the highest then in use on the G.E.R.—0-6-0 No 1119. It left a lot of blanks to be filled.

The cylinders of No 1900 were 19 in. dia. × 26 in. stroke and had the steamchest below. Balanced slide valves were used; they had a steam lap of $\frac{1}{4}$ in. and a travel in full gear of $3\frac{7}{16}$ in. They were operated by a well laid out Stephenson link motion; the inclination of the cylinders was 1 in 16, which gave plenty of clearance above the bogie. The lead was $\frac{1}{8}$ in. and an exhaust clearance of $\frac{3}{16}$ in. was provided. The length of

GREAT EASTERN RAILWAY No 1900—C





the ports was 16¾ in. and their widths were 1⅝ in. for the steam ports and 3½ in. for exhaust.

The boiler was made in two rings, the larger of which had an outside diameter of 4 ft 9 in., the plates being ½ in. thick. The barrel was 12 ft 1 in. long between the tubeplates and its centre line was pitched 8 ft 3 in. above rail level. The firebox casing measured 7 ft long and 4 ft 0½ in. wide, outside, and the grate area was 21.3 sq. ft. A total heating surface of 1,630.5 sq. ft was made up of 1,516.5 sq. ft for the tubes and 114 sq. ft for the firebox; the working pressure was 180 p.s.i.

A driving-wheel diameter of 7 ft had been used successfully on a number of previous classes of G.E.R. express locomotives, single and coupled, and was adopted on the Claud Hamilton class, though for the last time on the G.E.R.; the bogie wheels were 3 ft 9 in. dia. A total wheelbase of 22 ft 6 in. was divided into 6 ft 6 in. plus 7 ft plus 9 ft, while the front and back overhangs were 2 ft 9 in. and 4 ft 4 in., respectively.

The tender was of a type that had been developed for use on those engines which were equipped for burning oil fuel on Holden's system; its corners and top edges were rounded, and the fuel space was provided with a raised coping on three sides. The wheelbase was 12 ft, equally divided in the case of *Claud Hamilton*; the wheel diameter was 4 ft 1 in. and the overhang at each end was 3 ft. The tender's capacity was for 2,790 gallons of water and 750 gallons of oil.

This fine engine weighed 50 tons 6 cwt 1 qr, in working order, the tender 35 tons 1 cwt, while 37 tons 3 cwt 3 qr rested on the coupled wheels, thereby providing adhesion which surpassed that of most other four-coupled express engines of that time; in fact, it was only just under the prevailing maximum permissible limit of 40 tons for two axles.

James Holden was responsible for the general design, but the details were worked out by W. V. Russell, A. M. Bell and A. J. Hill. The result was a veritable triumph which won its due reward at the Paris Exhibition; for Holden was awarded the Grand Prix, Russell and Bell a silver medal each, and Hill a bronze medal.

Years later, Bell told me that they would dearly have loved to try the engine out on a French railway, but the necessary arrangements could not be made. Bell was of the opinion that the underlying reason was that the engine was too heavy for the French track. He may have been right; but he was obviously proud of *Claud Hamilton*, and I am sure that the same applies to everybody who had anything to do with the design construction and subsequent running of this splendid engine and her sisters.

Bell's periodical, *The Locomotive Magazine*, devoted much space to *Claud Hamilton* in 1900 and published a very fine coloured plate of the engine. In 1901 *The Railway Engineer* published the working drawings, a complete specification and a large engraving. All these have been freely used in the preparation of my drawing and these notes.

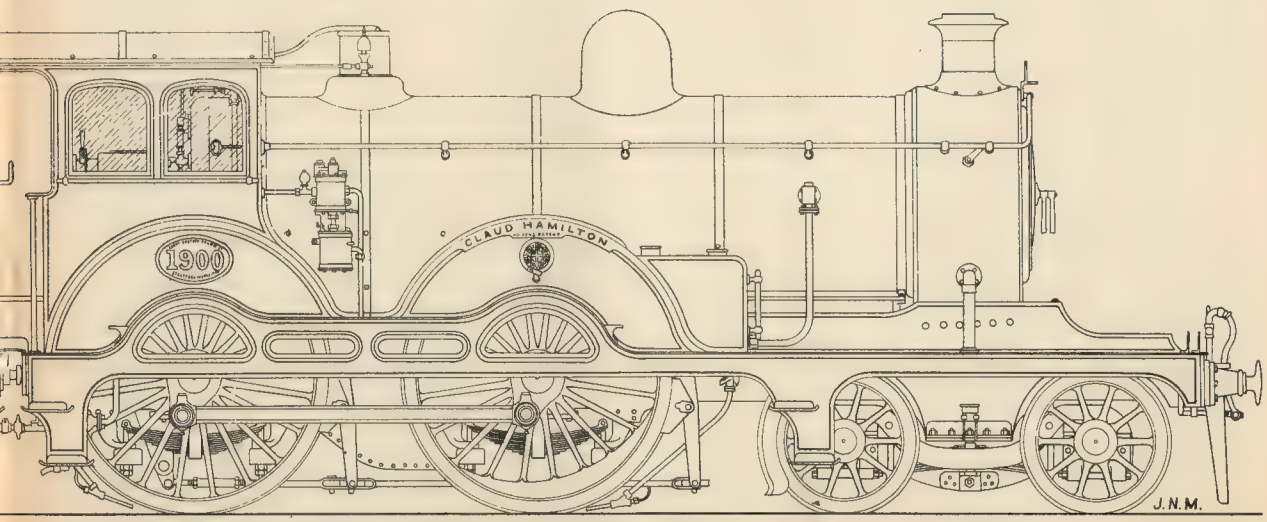
Although I was never a frequent visitor to East Anglia, I have recollections of runs behind Clauds; and in each case it was a good if not specially spectacular performance The loads were always quite heavy, but the engines ran well and usually managed to gain a minute or two on schedule.

My second encounter with *Claud Hamilton* herself was at, of all places, the Midland Railway's London terminus, St Pancras, where I was surprised to find her standing in the middle siding one afternoon waiting to take a train to Southend-on-Sea. This was some time in 1905, when there was a regular G.E.R. service to Southend from St Pancras, worked by G.E.R. engines and stock.

But it was not often that a top-link G.E.R. express passenger engine could be seen on this job, and I fancy that *Claud Hamilton* was either being run-in after some repairs or was making up some mileage on secondary work before being sent to Stratford for an overhaul. But I clearly recall that the engine had a plain smokebox door without the prominent and decorative bright-polished steel rim. Strange how such an important detail is so noticeable when it isn't there !

Claud Hamilton was withdrawn from service, as L.N.E.R. No 2500, in May 1947; like the majority of the class, she was never rebuilt. Some of the rebuilds, together with later L.N.E.R. developments of the type, are still in service. ▣

CLAUD HAMILTON— A really handsome exhibition piece which was also a splendid performer



A NARROW-GAUGE LOCOMOTIVE for passenger hauling

L.B.S.C. begins this week a description of a 1¾ in. gauge locomotive which will run around the back garden with a living load

WHEN full-size railway engineers want to lay a line from here to there and they find that the suggested route is such that numerous sharp curves are unavoidable and that standard-gauge locomotives and rolling stock would be very unsuitable, they adopt a narrow gauge. The erstwhile Lynton and Barnstaple line and the resurrected Festiniog Railway are examples of narrow-gauge lines that could not have been worked by ordinary rolling stock.

When some small railway enthusiast has a yearning to lay a line in a suburban back garden of average size —say about 20 ft × 40 ft—he is faced with a similar problem. He naturally wants a continuous track; little pleasure can be got from shunting up and down a short straight line on which the engine has no chance to show its paces. After allowing for clearance between the line and the surrounding walls or fences, he finds that his curves will be of such small radius that a locomotive of some type with a very short fixed wheelbase will be necessary—and if he adopts 3½ in. gauge he will be restricted to a four-wheeled "pug." Then, if he goes down to 2½ in. gauge, he has a better choice but can only use relatively small engines of "scale" dimensions.

He can, of course, build a freak which might possibly do the job, but look like nothing on earth. If he goes down still farther—to 1¾ in. gauge—he can build an engine which will not only look good and do the job as well, but can be a copy of any of the larger standard-gauge types. If he wants exceptional hauling-power, he can build a narrow-gauge engine and get the power without making it an outsize abortion.

He may possibly object to a narrow gauge on the score that riding on a narrow flat car would need extraordinary skill in maintaining balance, especially on sharp curves. The answer to that one is easy: a third rail can be laid to 3½ in. gauge, and the passenger cars built to run on that. A 3½ in. gauge car with two four-wheel short-wheelbase bogies will run over any curve that a 1¾ in. gauge locomotive will negotiate. The coupling on the car should be so placed that it will line up with the drawbar hook on the engine when both are on the track. I have used this wheeze for more years than I care to remember.

Some personal experiences

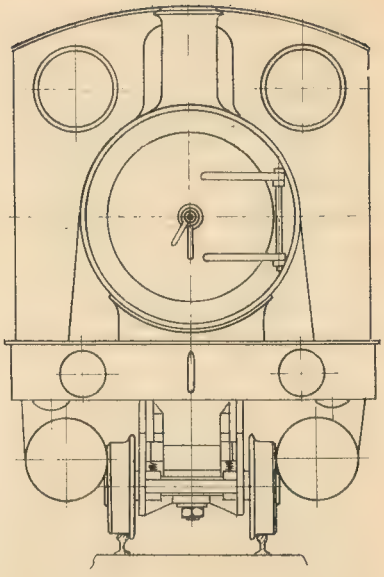
In case anybody should be doubtful of the ability of a 1¾ in. gauge locomotive to haul living loads perhaps a few of may own personal experiences may be of interest. The very first locomotive that I described in detail in these notes—over 30 years ago—did that little job nicely. She was an American 4-6-2 and I called her *Ford Pacific* because she was cheap to build, and simple and powerful like the famous Tin Lizzies.

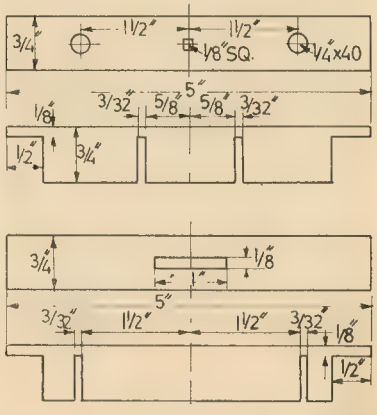
In the notes I specified a coal-fired boiler. But an American friend, the late Joe Lozier, worried me to build one for him with a spirit-fired water-tube boiler. The casing of this was exactly the same size as the shell of the coal-fired one, and the cylinders and motion were identical. It was fired by four spirit wicks, and to get a hot feed from the eccentric-driven pump the feed pipes ran around the space between the outer casing and the actual boiler, the water entering through check valves at the front end. A cold feed entering a water-tube boiler would have caused a drop in pressure, but the hot feed had no effect—and it made use of heat that would have otherwise been wasted through the casing.

Joe was a big man, weighing about 18 stone, and when he came to my old home at Norbury to see the engine in steam I coupled her up to my passenger car and told him to take a seat and open the throttle. He thought I was pulling his leg . . . but anyway he did as he was bid, and the look on his face when the engine promptly moved off with him would have got him a star job in Hollywood! He was so astonished that he let go the throttle and clung on to the car with both hands, yelling "Can't believe it —'tain't true—'tisn't possible!" as the engine gathered speed on the 65 ft straight run.

I could hardly do anything for laughing, but I ran after the outfit and caught the car before the engine hit the dead end, reversed her and let her push Joe back again. When he recovered from the shock, he drove her up and down until the lamp tank ran dry.

He brought her along to the New York S.M.E. Exhibition in 1929, and she took a turn at passenger-hauling, amazing the visitors by hauling myself and a boy up and down the track with little effort. The





The front view, buffer beam and drag beam

American daily papers published a picture of her as a "wonderful example of potted power"; naturally, being an American engine, she appealed to them.

I rebuilt a similar type of engine—but commercially made—for another friend, a Yorkshire schoolmaster. This one had slightly smaller wheels and $\frac{1}{8}$ in. shorter stroke, but after I had finished with her, she hauled her 14-stone owner on the heat generated by four spirit flames. Before treatment she couldn't keep going with three tin coaches without losing pressure.

Soon after that a correspondent who had an extensive scenic railway at Melton Mowbray was smitten with the Hughes 4-6-4 tanks then running on the L.M.S. and asked if it would be possible to build a $1\frac{3}{4}$ in. gauge version of one with a coal-fired boiler. I replied that it would. Several weeks after he wrote saying he had tried several firms but that they all said it was impossible . . . the firebox would be too small to keep a fire going.

That sort of thing gets my back up and I promptly informed him that I would build one myself, just to prove that they didn't know what they were talking about. She was very simply made, for speed in construction, with centrally-sprung bogies and loose-eccentric valve gear. The fire not only burned all right, but made enough steam to haul my weight continuously.

My correspondent was dumbfounded when I invited him to see it in action, and he promptly made me a cash offer for it. Not being particularly interested in that size, I let him have it. He eventually sold up and went abroad, and the engine went to the U.S.A.

Soon after the Kaiser's war one of the many mushroom "model" firms that sprang up put a series of spirit-fired locomotives on the market that were little more than scrap.

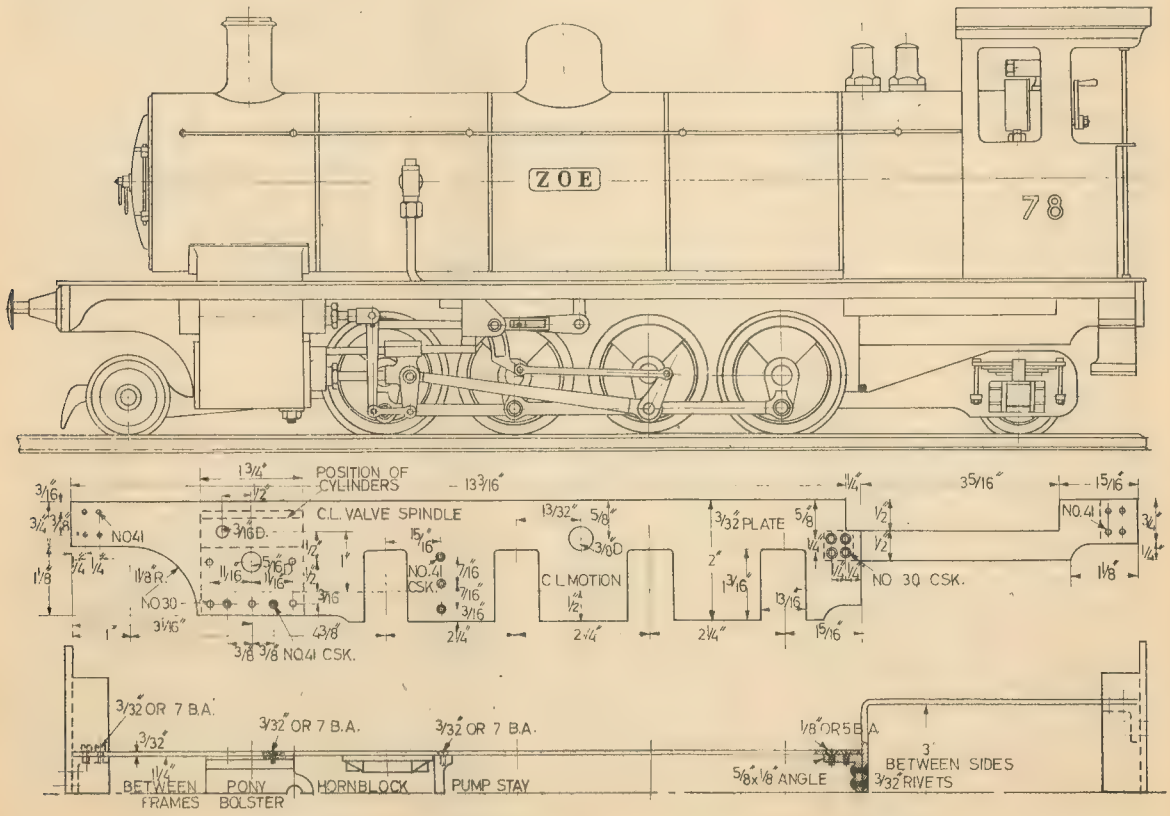
A Yorkshire correspondent bought a $1\frac{3}{4}$ in. gauge G.N.R. Atlantic from one, but it was hardly able to pull its own tender, much less a train. He got in touch with me through this journal and told me his tale of woe, offering to send the engine for inspection. Being interested in seeing the difference in what was advertised and what was made I agreed. It was a sample of the worst workmanship I have ever seen.

After pulling it to pieces—incidentally, it didn't need much pulling as being mostly soft-soldered together it kind of disintegrated under a gas flame—I thought it a pity to put the bits together, so I rebored the cylinders and fitted fresh valve gear, titivated up the boiler and did a few more odd jobs. When tried on the track, it pulled my weight quite well though a bit slippery at starting. I heard afterwards that it regularly hauled two children on a line that the owner put up in his garden.

I think these examples of what "scale-size" standard-gauge locomotives can do on a $1\frac{3}{4}$ in. gauge line will prepare you for the following description of a narrow-gauge type of locomotive which will not only haul several passengers, but run around curves which are well within the capacity of even a small garden.

A $1\frac{3}{4}$ IN. GAUGE MIKADO

The design of the locomotive illustrated here was prompted by my $2\frac{1}{2}$ in. gauge 4-12-2 *Caterpillar* which I built in 43 days way back in 1926—



The general arrangement, with the elevation and plan of the frames

NARROW-GAUGE LOCOMOTIVE . . .

still running !—and is one of the most powerful engines ever put on that gauge. She also incorporates several features from other engines that I have built, all tried, tested and not found wanting. As shown, she is virtually a " half-inch scale " edition of a type of locomotive built by Kitson's for the South African Railways somewhere around 1906—before they went in for articulated locomotives. But I have substituted plate frames for bar frames and Walschaerts gear for link motion, and made other modifications suitable for the small size required.

The frames are made in two sections: the main frames which carry the wheels and working parts, and the rear cradle which supports the back end of the boiler. The horn slots are arranged to take the standard hot-pressed hornblocks sold for ordinary 2½ in. gauge engines, and the use of these saves machining as the pressings only need cleaning on the rubbing-faces with a file after being fitted to the frames.

The axleboxes are the same as specified for *Tich*, with overhead springs, eliminating any need for spring plates and pins. *Tich* wheel castings are used, so no fresh patterns will be required. The two middle pairs of wheels are flangeless, and with the ample swing given to the leading and trailing pony trucks the engine will take curves as small as 6 ft radius, but naturally at reduced speed.

Plenty of power

The coupling rods are made on the system used by Francis W. Webb for some of the eight-coupled engines on the L.N.W.R., each being in three pieces so that full flexibility is obtained without the use of separate knuckle joints, the action being assured by putting adjacent bosses on the same pin. The cylinders are the same as those specified for *Tich*—and anybody who has seen a properly-built *Tich* in action will need no further proof of the power that they can develop nor of the speed with which they can turn wheels. The *Tich* crosshead, guide bar and bracket are also used, and the dimensions of the valve gear are the same.

The actual layout of the gear differs inasmuch as the radius rods are lifted and lowered by dieblocks on the ends of the lifting-arms, working in the slotted ends of the radius rods which are extended beyond the links for this purpose. This puts the yoked link out of court, and the one shown has one single long bearing in place of two short ones. The wearing properties are not affected in the slightest, and the assembly is easier.

The cylinders stand out ⅛ in. farther from the frame than those of *Tich*; a pair of castings that I have here now have sufficient metal to allow for machining to this dimension, but any that will not clean up to it can easily be utilised by putting a brass plate between the cylinder and frame in order to pack out the cylinder to the given dimension.

The buffer and drag beams may be cast or made from angle, and the pony truck frames may also be cast or built up. If cast, the trailing truck should have the dummy spring and horns cast on it, which will save time and labour. The axleboxes are sprung, the spiral spring being concealed in the hoop of the cast dummy.

Greater tractive effort

The boiler is an enlarged edition of that on my old stager *Ayesha*, with a wide firebox and ample grate area. As *Ayesha's* boiler has no trouble in steaming a larger pair of cylinders when pulling three or four adults, there will be no fear of a larger boiler failing with a smaller pair of cylinders. The tractive effort of the engine will be greater than *Tich*, as there are twice the number of coupled wheels, and with the greater adhesion she will be able to work at a higher pressure if needed.

The boiler will be fed by a special type of pump, necessary because of the limited distance between the axles. An injector may also be fitted. Boiler fittings and mountings and other accessories will also be to L.B.S.C. standards. The tender will run on two four-wheel bogies, so that it is as flexible as the engine. The superstructure I am keeping as simple as possible to save work and speed up production; builders naturally want to see the wheels turning on the track, and if a job hangs out it becomes uninteresting.

Note—very important this—although I have shown the engine as a 1¾ in. gauge job, she can be built to twice the given dimensions for 3½ in. gauge, and in that size would be nearly able to pull the Eddystone Lighthouse off the rock and tow it to John-o'-Groats ! With a 6 in. boiler, cylinders 1½ in. × 2¼ in., and 4½ in. wheels, the engine would be more powerful than the 4-6-2 which I rebuilt while in the U.S.A. many years ago. She started 1,990 lb. from a dead stop on a 1 in 70 grade and started three tons on the level. All being well, I will give the necessary variations.

Meanwhile, here is something for 1¾ in. gauge builders to kick off with. I don't propose to make a long-drawn out tale of the job, and will keep instructions as brief as possible.

FRAMES AND CRADLE

For the main frame plates two pieces of soft mild steel of 13-gauge, 13½ in. long and 2 in. wide, will be required. Mark out one of them as shown on the drawing, drill a couple of the screwholes—one at either end—rivet temporarily together and saw and file to outline. The location of all the principal screwholes is shown. The two countersunk holes under the cylinders' position are for screws to hold the pony bolster in place while the cylinders are being erected. The cylinder studs pass through the pony bolster flanges and hold the lot securely. The large hole between the two middle horn slots is for the reverse-shaft bush, so be careful to locate and drill it correctly.

The trailing cradle is made from the same kind of material. I have shown it cut in one piece with bent corners. It can also be cast complete with the drag beam and the lugs for attaching to the main frame. Also it may be made with separate sides attached to the front section by pieces of angle at each corner, the front section being attached to the main frames by angles and rivets as shown.

The buffer and drag beams may be cast or made from ⅞ in. × ½ in. steel angle. If cast, the fixing lugs will be integral and no separate angles will be needed. The drawing shows how the lot is assembled if angles, screws and rivets are used, but if I were building the engine myself I should put all the joints together with my oxy-acetylene blowpipe and a spot or two of Sifbronze.

● *To be continued*

HISTORIC LOCO MODELS

Locomotives Worth Modelling, by F. C. Hambleton, gives descriptions of many famous engines of the pre-grouping period including: the old Midland No 1447; London and South Western No 591; London Chatham and Dover No 145; the famous Great Northern Number One; and the Manchester, Sheffield and Lincolnshire No 694.

Lavishly illustrated throughout its 176 pages with detailed drawings it is obtainable from Percival Marshall and Co. Ltd, 19-20 Noel Street, London, W.1, price 10s. 6d., postage 8d. (U.S.A. and Canada $2.50).

A MIXED BAG . . .

Which includes information on a Swedish tool claimed to be "the answer to a countersinker's prayer"

THE pleasures derived from writing are enhanced by the occasional receipt of interesting letters and comments from readers. Recently the start of a new day was enlivened by the arrival of a small packet which contained a letter from a Mr Hede, a Stockholm civil engineer, together with two sample countersink tools of original design, and I am sure I could not do better than to quote Mr Hede:

"I have read Mr Martin Cleeve's troubles with countersinks [Workshop Topics, 7 February 1957] with sympathetic feelings, because I have had the same troubles myself. It is, as he says, that the slowest speed of the amateur's bench drill is much too fast for ordinary countersinks. However, my troubles belong to the past, and that is why I am writing this letter. About five years ago a tool appeared in this country, which was the answer to the countersinker's prayer. So it was one up that time for the highly-paid white coated scientists of whom Mr Cleeve speaks: they had had their thinking caps on before starting manufacture."

Fig. 1 will give an idea as to the actual design of the tools. It will be seen that a cutting edge is formed in the conical end by the simple expedient of drilling a hole through the body of the tool at an angle of about 45 deg. The second illustration shows how this hole also serves as a passage for the swarf.

In order to test the tools I chose a piece of $\frac{1}{4}$ in. thick bright mild-steel bar into which I drilled a number of holes of varying sizes—from $\frac{1}{8}$ in. up to $\frac{3}{8}$ in.—and, selecting the larger of the two countersinks, I plunged it straight into one of the $\frac{1}{4}$ in. holes at 635 r.p.m., having first applied a little coolant with a brush. Although I think it will be conceded that a speed of 635 r.p.m. was a little unkind to a tool of this nature, the result was a perfectly smooth and chatter-free countersink. Further tests at 370 r.p.m. on $\frac{1}{4}$ in. holes showed that the tool would have given every satisfaction for indefinite periods.

Testing the smaller tool at 635 r.p.m. on holes of $\frac{1}{8}$ in. and $\frac{5}{16}$ in. left nothing to be desired while the larger opened up a $\frac{3}{8}$ in. hole at 212 r.p.m. without a murmur.

Glancing again at Fig. 2, the reader will notice that the tool produces genuine "turnings"—not merely a lot of broken chips as do many countersinks of more orthodox design. Of course, for this particular test and picture I allowed the swarf to accumulate to an unnecessary degree; under normal working conditions one would naturally remove this.

The behaviour of ordinary countersinks on brass is notoriously erratic but readers will be interested to learn that these Swedish tools gave first-class results. A $\frac{1}{4}$ in. hole, for instance, was enlarged to $\frac{7}{16}$ in. dia. at the mouth of the countersink, at a speed of 950 r.p.m., and a further enlargement to $\frac{1}{2}$ in. dia. was made at 1,500 r.p.m. At this very high speed there was, of course, a tendency to chatter, but this could be eliminated by plunging the tool into the hole in a decisive manner.

Mr Hede says if there is any disadvantage with this type of countersink, it lies in the fact that a set of different sizes is required to cover a range. As far as I could tell, these two samples of $\frac{9}{16}$ in. and 9/32 in. dia. appeared to have a range sufficient for most light engineering and model work, but doubtless it would be as well to follow the makers' recommendations in this respect.

For those interested, Mr Hede will be pleased to give the address of the makers and to find if they have any British agents.

MARTIN CLEEVE.

SCHOOL'S MODELS

MODEL engineering can be a useful and interesting subject in the school metalwork shop.

This is being put into practice at Audley Park Secondary Modern School, Torquay, for the metalwork instructor, Mr Wellands, himself a keen model engineer, has introduced model building into his curriculum.

This workshop, a new structure, is elaborately equipped, and the senior boys, having passed the stage of simple filing, sawing and riveting, are now tackling L.B.S.C.'s *Virginia*. The main frames have been constructed, and the driving and coupled wheels have just been machined.

The young workers are fortunate

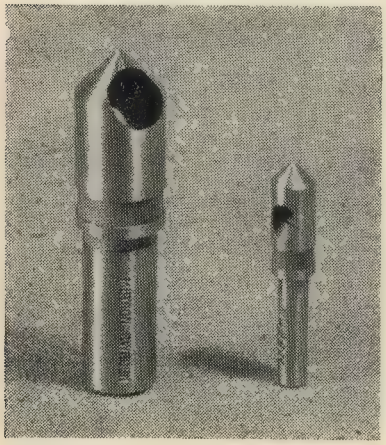


Fig. 1: Left: Two Swedish countersink tools. The illustration is approximately actual size

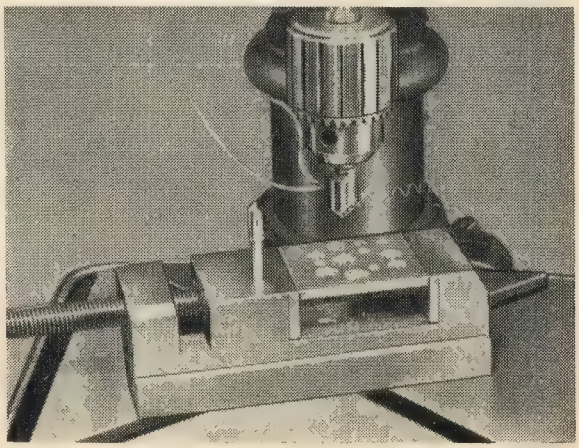


Fig. 2: Right: Chatter-free countersinking at speed. The easy cutting action is evident from the unbroken swarf

A MIXED BAG . . .

in having two lathes—a Myford Super 7 and a 5 in. Harrison.

Mr Wellands stays on for an hour or so two evenings a week to allow his boys full opportunity to make further progress with their work. The boys need no second bidding ! As soon as ordinary school ends, there is a mad rush for the workshop.

Besides *Virginia*, other smaller models are being built—individually. One of these is Edgar T. Westbury's *Theseus*, which is being constructed by young Raymond Hasler. He has built up his cylinder, and fixed the flanges. One cylinder cover is in place, and he now has to turn and fit his piston. At present he is making the trunk guide and standard.

Another enterprising lad is at work on a space rocket—and it is giving him plenty of engineering practice in turning and fitting.

R. W. TANDY.

AN OLD-TIMER

THE pictures on the next page are of an old-timer, which is supposed to be a model of the Webb compound 4-4-0 *Iron Duke* of the L.N.W.R. It is of an unusual gauge, i.e., 4 in. (which represents a full-size gauge of 5 ft 4 in., slightly more than the present Irish gauge of 5 ft 3 in.). The engine seems to have been built in $\frac{3}{4}$ in. scale.

There are only two cylinders, of course, and the bore is $1\frac{3}{16}$ in. and the stroke $1\frac{1}{4}$ in. Cylinders, valve gear and all wheels are of hard brass. The cab is fitted with Ramsbottom spring-loaded arm, handle regulator, water and pressure-gauges and level cocks. Stephenson's double-eccentric link-motion valve gear is fitted with reversing lever in the cab.

There are also three four-wheel passenger coaches, one directors' saloon, and one guard's van all made of mahogany, the interiors being complete with upholstered seats. The entire train—engine, tender and coaches—is sprung throughout.

Firing is by ordinary six-burner spirit lamp, and the boiler has four firetubes.

Unfortunately, a lot of the paint-work has been burnt but where it is undamaged the old L.N.W.R. livery looks very fine. The brass plates on the sides of the cab bear the number 1903, which may also refer to the date of building.

M. K. HUGGARD.

A TAPER TURNING ATTACHMENT

THIS is a device which I fitted to my ML7, and I feel it has much to commend it for simplicity, ease of construction, and accuracy in setting up, besides convenience in use.

First, you will need a sine table—they are to be found in any engineer's pocket diary and are obtainable at any bookseller's for a few coppers.

Now suppose you need to turn a taper of 1 deg. 26 sec. You will find the sine to be 0.025, so move the decimal point one place to the right which will give 0.25 or 250 thou on your cross-slide index. Mount your dial gauge on the cross-slide and feed until it just makes contact with pivot pillar *C* at the headstock end, then rack to the sliding pillar and feed 250 divisions of the index with the dial gauge just making the same contact. Clamp both pillars and check. Remove the cross-slide leadscrew, fit the connecting plate *A* to the cross-slide and sliding bush *B* and you are all set for your taper of 1 deg. 26 sec. on the radius. And I have no doubt you can use test blocks instead of the dial guage if you wish.

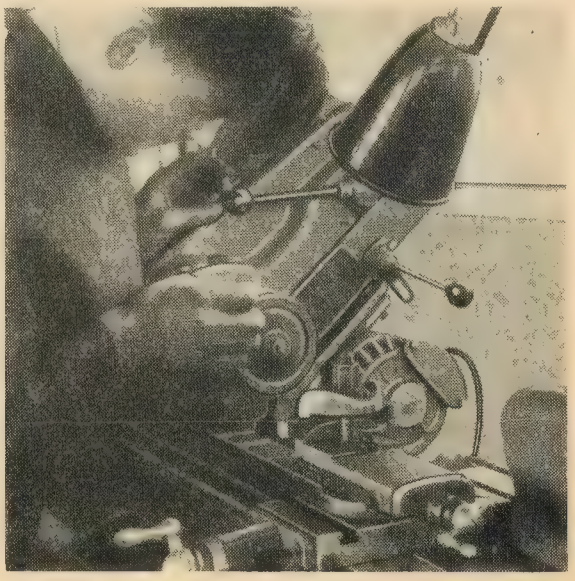
You can use a feeler gauge with a bit of care, but you will need a lot of care in setting the tool to centre height with any taper turning.

I was rather diffident about putting any dimensions on the drawing because there are so many owners of lathes other than ML7s—and they may feel neglected in this matter of attachments. But with a little in-

genuity one can soon adapt. Thus, if your lathe is smaller than the ML, make the sine bar 5 in. instead of 10 in.

The bracket *D* in my case is an iron casting, but if this is out of the question use a piece of stout angle with brackets of $\frac{5}{16}$ in. plate riveted on. The pillars *C* can be of any convenient diameter, but the diameters of each must be idential. I used a piece of $\frac{9}{16}$ in. silver steel for the sine bar *E*. The bar was reduced at both ends to form dowels and sweated into holes in the milled faces of the pillars while they were clamped in the bracket

Top: Raymond Hasler machining the standard for THESEUS *on a 5 in. Harrison*



Right: A keen Audley Park pupil polishing a VIRGINIA *driving wheel on a Myford Super Seven*

A real old-timer . . . supposed to be a model of the Webb compound 4-4-0 IRON DUKE *of the L.N.W.R.*

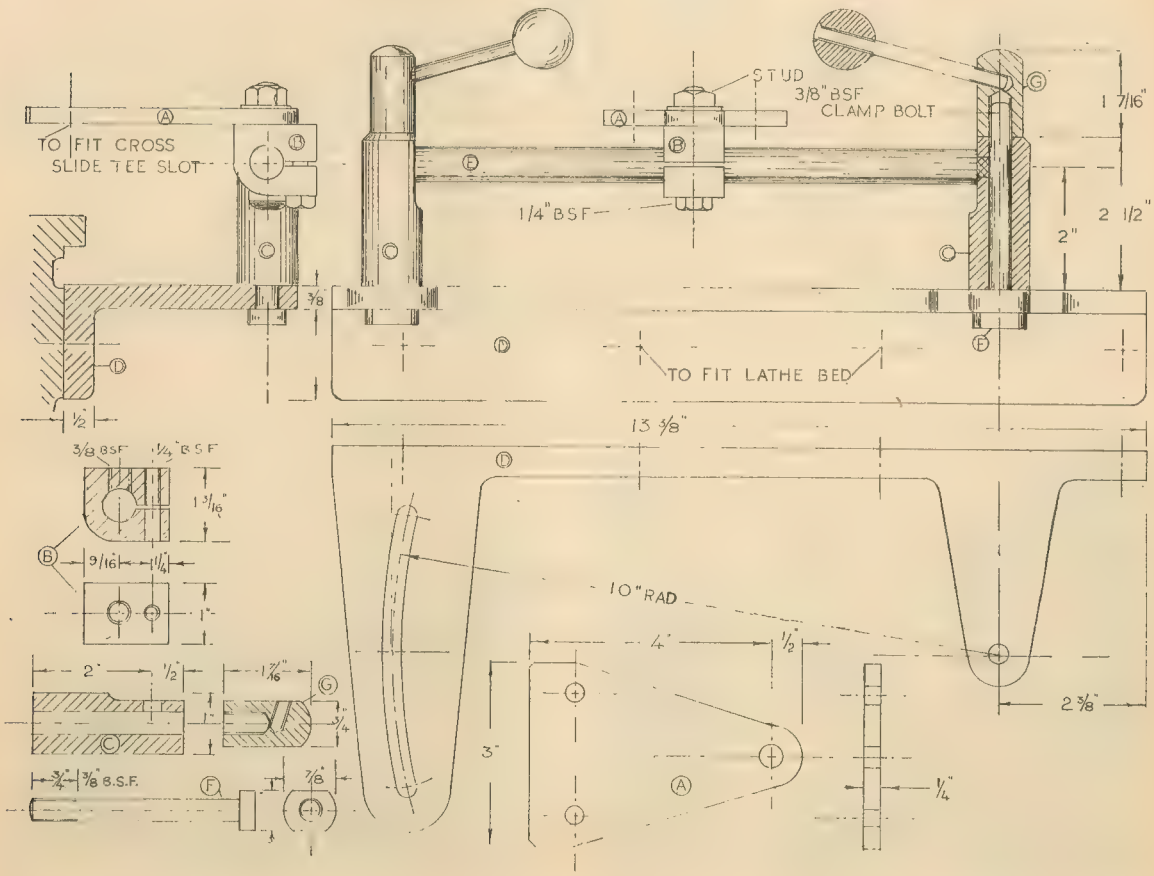
casting. The critical part of this is that the centres of the pillars must be spot on 10 in.

The capacity is about 25 deg., including the angle, and the length of taper is about 8½ in. It can be left set-up—but with a reduced cross-slide travel with a standard ML7 cross-slide. The bracket may be left permanently attached to the lathe, and then the fitting of the sine bar is the work of a moment. You can set up to a tapered article mounted between centres.

Finally, I have no doubt it could be adapted as a copy-turning device.

R. MATTHEWMAN.

Working drawing of the sine bar taper turning attachment described on the preceding page and above



EXPERT'S WORKSHOP

A cutting oil feed for the lathe

BY DUPLEX

IN a recent television programme a visit to an aircraft factory was broadcast in which was shown an interesting new method of supplying cutting oil to a large duralumin framework during machining.

To spray the oil on the work surface at the point of tool contact a special form of gun was operated from the factory compressed air line.

This method appears to have several advantages over those in common use; for here the lubricant is directed to the exact point required and a minimum amount of cutting oil is used; in addition the accompanying air blast serves as a coolant to reinforce the action of the oil.

Hitherto, the methods generally adopted in the small workshop have not proved entirely satisfactory. Applying the cutting oil to the work with a brush held in the hand is a tedious business when taking a long cut, and an oil brush fixed to the toolpost so that it follows the travel of the tool soon becomes clogged with swarf and ceases to feed the oil. Cutting oil delivered by a pump from a large reservoir is liable to cause trouble in an in-door workshop unless elaborate screening precautions are taken to prevent the lubricant from splashing the walls or flooring.

On the other hand, the small spraying attachment illustrated in Fig. 1 has been found to overcome these difficulties and to give satisfactory service.

By means of an easily detachable fitting the spraying head is mounted on the lathe cross-slide so that it keeps in step with the tool as it travels along the work. Only a very small quantity of oil need be sprayed to afford adequate lubrication, and in the interests of the operator care must be taken to guard against filling the air with oil mist.

The spray gun is supplied with air by a piston-type rotary compressor, which in the present instance is mounted on one of the vertical members of the lathe overhead and driven by a belt from the lathe countershaft. When not in use the gun together with its saddle mounting can be quickly detached and slung from a pair of hooks attached to the crossbar of the overhead.

The belt drive has been arranged to serve as a clutch for throwing the compressor into or out of action; moreover, the spray ceases immediately the lathe is stopped and returns as soon as the lathe is restarted. To allow for the movement of the lathe saddle the compressor is connected to the gun by a length of oil-proof plastic tubing.

The compressor used in the present instance is one of those made by Rotherhams for supplying air pressure to the petrol tanks of aircraft in the first world war. A subsequent article will describe the making of a compressor unit of this type which has been modified in certain details to facilitate the construction and machining.

The cylinder head is fitted with an adjustable spring-loaded blow-off valve which enables the air pressure to be varied for adjusting the volume of the air spray to suit the working conditions. The oil container consists preferably of a small glass jar so that the level of the liquid can be readily checked.

THE CONSTRUCTION

It is best to start by selecting a 2 oz. glass jar fitted with a sheet-metal screw-on lid. After the $\frac{1}{4}$ in. dia. mild-steel bar *A* has been cut off to length, a flat is filed at one end and the two 6 B.A. screws are fitted so that the part can be secured to the lid of the container.

The oil-feed tube *B* is made from copper tubing of $\frac{1}{16}$ in. outside diameter and one end is threaded 10 B.A. for mounting the nipple *C*. The length *X* of the vertical limb of the tube is adjusted to allow the feed pipe to reach nearly to the bottom of the container.

Fig. 1: *The oil spray gun mounted on the cross-slide*

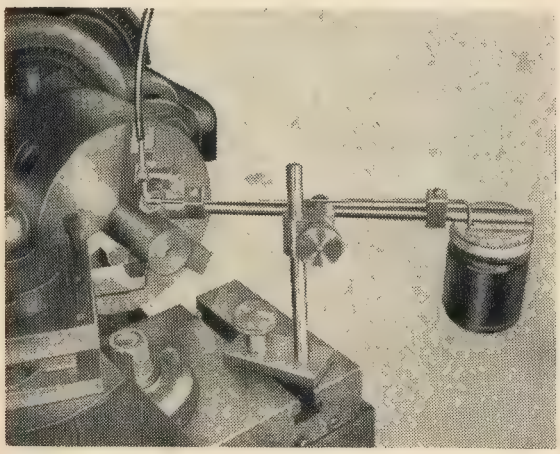
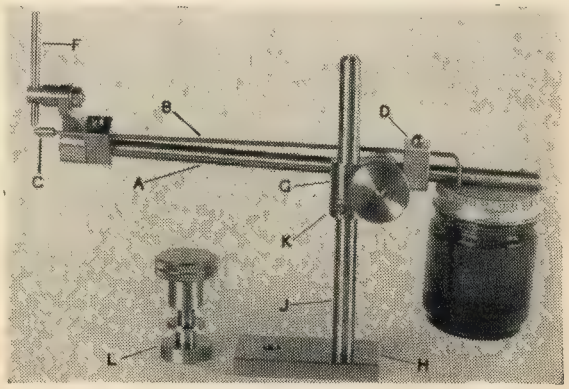


Fig. 2: *The spray gun on its mounting.* (*a*) *the bar*; (*b*) *the oil tube with* (*c*) *its nipple*; (*d*) *the oil tube mountings*; (*f*) *the air tube*; (*g*) *the mounting clamp*; (*h*) *the attachment base*; (*j*) *the pillar*; (*k*) *the height adjustment collar*; *and* (*l*) *the T-bolt*



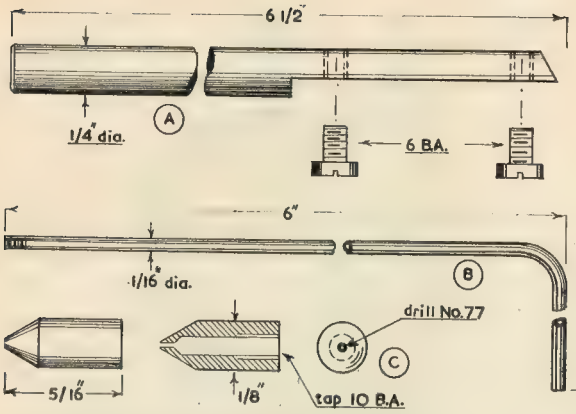
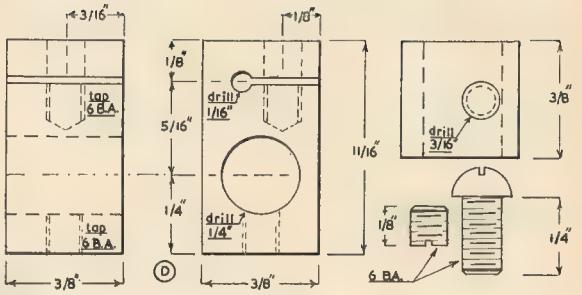
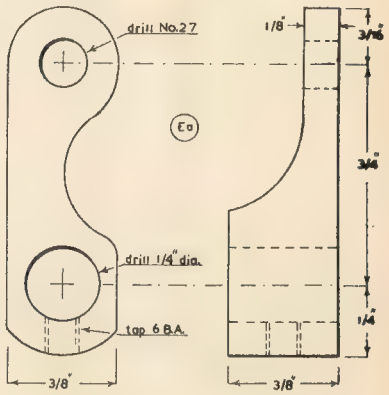


Fig. 4: The bar and oil tube with its nipple



Above, Fig. 5: The oil tube mountings



Right, Fig. 6: The air tube bracket

The nipple was machined from $\frac{1}{8}$ in. dia. brass rod, which when gripped in the lathe chuck was bored axially for a short distance with a No 55 drill and then tapped 10 B.A. At the same setting of the work a No 77 drill was entered for a further $\frac{1}{8}$ in. before the nipple was parted off to length and finally reversed in the chuck for forming the coned tip.

The two small clamps *D* for securing the oil-feed pipe to the bar are made from $\frac{3}{8}$ in. square brass rod. When making the pair of parts it will save time if a piece of rod several inches in length is used, for one clamp can then be machined at either end and there will be no difficulty in mounting the work in the lathe toolpost for slitting the end with a circular metal saw mounted on an arbor between centres.

The oil tube should be a good fit in the cross-drilled holes in the clamps, so that it becomes firmly held when the 6 B.A. clamping screw is tightened. The clamp itself is secured to the bar by means of a 6 B.A. brass grubscrew.

FITTING THE AIR TUBE

The $\frac{1}{8}$ in. dia. copper tube, which is connected to the compressor, provides an air blast across the end of the oil tube and so produces a fine oil mist after the manner of a scent spray.

This spray can be readily directed to the point of contact between the lathe tool and the work, for it is delivered with some force and if unimpeded will travel for a considerable distance in still air.

The air tube *F* is furnished with a nozzle *Fa* that fits inside the copper pipe and is soldered in place by a simple sweating operation. To allow for the necessary adjustment to obtain the correct setting of the air tube, in relation to the nipple of the oil tube, the former tube is held in a swivel clamp which is carried in the bracket *Ea* for attachment to the bar of the appliance by means of a 6 B.A. grubscrew.

This bracket is also made from $\frac{3}{8}$ in. square brass rod which is drilled in accordance with Fig. 6 and afterwards filed to shape with a hollow for the passage of the oil tube. The swivel clamp consists of the parts *Eb* and *Ec*, Fig. 7; the former is cross-drilled to accommodate the air tube and is afterwards slit through the coned neck with a fine hacksaw.

The sleeve *Ec* is countersunk with a centre drill to match the angle of the coned neck of the draw spindle *Eb* so that after assembling the parts and tightening the clamping nut the head of the draw spindle will close on the air tube and secure it in place and, at the same time, the swivel clamp will become firmly locked.

This completes the construction of actual spraying mechanism and it can be given a trial when connected to an air supply having a pressure of 5 p.s.i., and by adjusting the position of the air nozzle in relation to the oil pipe a satisfactory spray should be readily obtained.

● *To be continued*

Fig. 3: (d) the oil tube clip; (f) the air tube; (ea) the air tube bracket; (eb) the draw spindle; and (ec) the sleeve

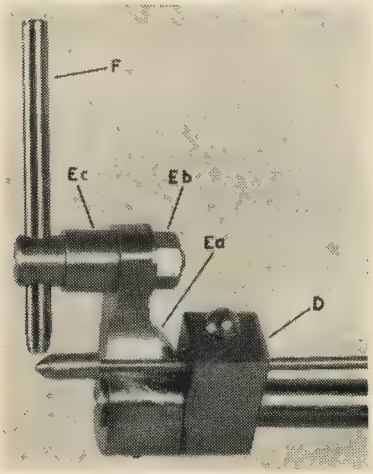
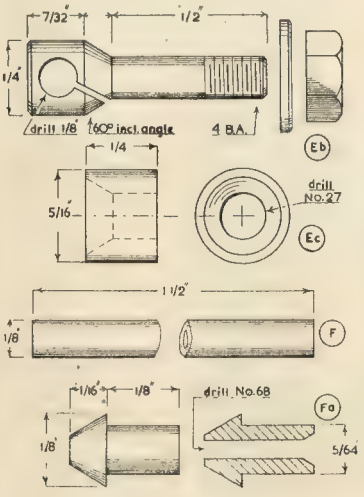
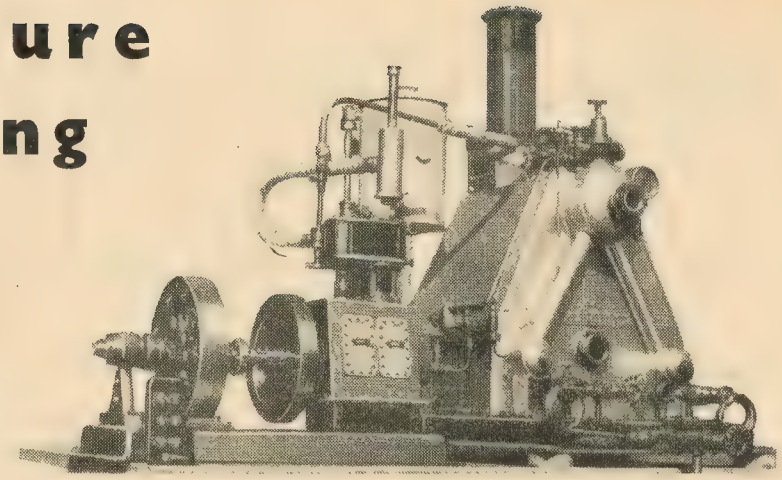


Fig. 7: (eb and ec) the air tube clamp parts; (f and fa) the air tube and nozzle



A miniature generating plant

H. J. REES of Vancouver writes about his miniature power plant that's fired by the city's gas



THIS is a complete power plant in itself. The boiler drives a model of a Bellis and Morcom high-speed engine which in turn is connected to a model of a modern generator, giving 40 v. at 500 r.p.m.

The boiler is larger than the one described in MODEL ENGINEER, 24 April 1952, and not only is it larger but it is fired by city gas, which has made a world of difference. I can raise steam in about 12 min.

It is fitted with two venturi-type burners which work just fine. When it was first tried we had coal gas in the city mains, and the size of the holes in the tips was nearly $\frac{1}{8}$ in., but as soon as natural gas from the Alberta oilfields was turned into the mains I had to reduce the size of the orifices a lot. They are only about $\frac{1}{16}$ in. at present and they work well.

The engine is a model of a single-cylinder high speed engine. It is 2 in. bore × $1\frac{1}{2}$ in. stroke. Both the crankshaft bearings run in ball-races and the bottom-end bearing is also ball type.

The crosshead guide is a radical departure from the common practice, as is the valve guide, for it would be a pretty tricky business to find room for one's fingers and tools inside the narrow top end of the closed-in frame to do any adjusting. The two guides were designed after the manner of a car piston, with the piston and valve rods screwed into the top and secured with a locknut.

These trunk guides have given no trouble whatever, except maybe to allow the odd drop of water to pass down into the crank chamber, but that is a matter for the engineer on watch to attend to !

The piston is made from dural with a single ring made from bronze. The first piston was made from bronze but it was later discarded and a duralumin one fitted in its place. There is quite an improvement in the engine with the latter one, as the bronze piston weighed 8 oz. but the one now fitted weighs 2 oz.

The slide valve, which is of the piston type, was made from mild steel, case-hardened and lapped into a bronze liner, and it made a pretty fair job, with inside steam admission.

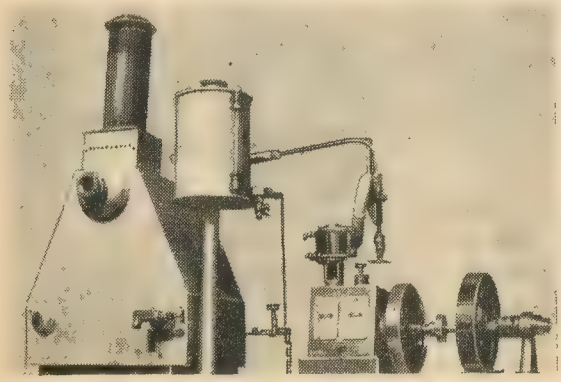
The cylinder was hacked out of a piece of solid cast iron of square section which had done duty once as a balance weight for a passenger elevator in one of our big department stores.

I may add here that my youngest son was responsible for making the engine; I made the boiler and the generator.

The main frame for the generator was taken from an old low-speed roof ventilating fan, as it suited my purpose much better than anything else that I could find in the scrapbox. It had a large diameter compared to its length, and so it looks much like a modern type of machine.

Only the frame was used; the rotor was discarded and a new shaft designed which carried a sleeve of mild steel, the outside of which was milled to an octagonal shape to take the eight pairs of pole pieces.

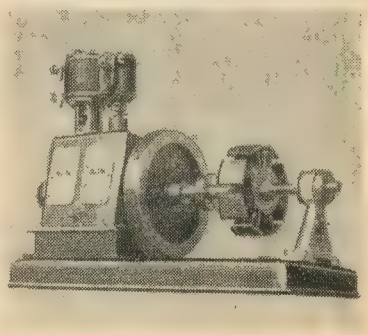
These pole pieces were made from



Top: Front view of plant, showing injector between engine and boiler

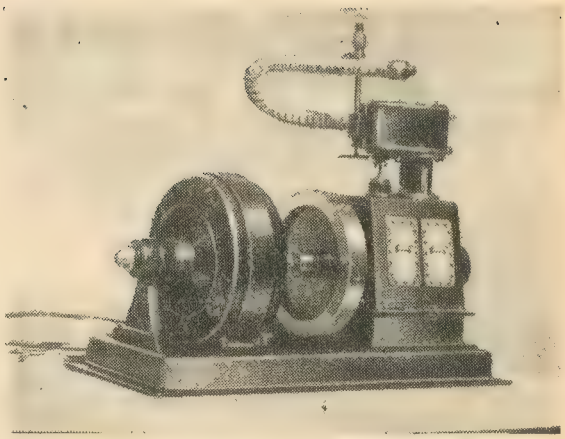
Left: Back view of plant, showing the water-tank. The generator is not quite assembled in this view

Below: Generator being coupled to the engine's driving shaft



Alnico metal, and were very highly magnetised. Here I ran into a snag, for when the pieces of Alnico metal arrived from the makers they were slightly more than double the length I wanted and had to be cut in half. Being so hard, ordinary tools would not touch them. I had no means of cutting them with an abrasive wheel, and being such a small job the machine shops would not be bothered with them.

I managed to borrow a small toolpost grinder from a friend. This was set up in the toolpost and a 3 in. × $\frac{1}{16}$ in. abrasive wheel was mounted on it. The piece of Alnico was held in the chuck jaws with about two-thirds of it projecting, and in this way I managed to cut a groove about $\frac{1}{8}$ in. deep. It was then taken from the chuck and laid on a small anvil with a sliver of steel under one end and struck a sharp blow with a copper hammer. In this way it broke clean, leaving rough ends, of course, which were squared up later.



The completed generator and engine

Magnet wrong way round

All these pole pieces were ground to exactly the same size: $1\frac{1}{4}$ in. long × $\frac{3}{4}$ in. dia. The octagonal rotor was taken in hand again and recesses machined to take the ends of the Alnico magnets to a depth of $\frac{1}{8}$ in. There were two recesses in each face, as the magnets are in pairs and side by side with a mild-steel cap over each pair. This cap is held hard against the magnets by two setscrews, the heads of which are sunk well below the outer diameter of the caps so as to be clear of the tool when turning down the diameter of the rotor to its final size.

A little incident occurred at this stage which I must mention.

When the job was first started up for trial I could not get it to show any current, no matter how I tried, but after a lot of tinkering around I came to the conclusion that one of the permanent magnets must be in the wrong way round.

The whole job was taken apart and sure enough my surmise was correct. I had to be careful to change the offending magnet, for if I had changed the wrong one the pole pieces on either side, ahead and behind of the one at fault, would certainly have been affected.

At the next test things were all right and the current climbed to 40 v. at 500 r.p.m. The electric shop increased its business about that time, for I was using auto headlight bulbs for my tests, and if someone opened up the engine stop-valve too suddenly away went all the lights, and I had another trip to the shop. But no one cared for we were having a lot of fun in bringing the little power plant to life.

After this I wired enough bulbs in series to take the full 40 v.

The generator develops alternating current as it does not have a commutator, but I got away from fitting an exciter by making use of permanent magnets.

This little plant has done its stuff at several exhibitions here at the Pacific National, and it has drawn a lot of interest from sightseers, especially from those who are mechanically minded. When they are electrically minded as well, I have to do some explaining when they notice the sign reading, "Alternating Current, 40 Million Volts Keep Clear."

The rotor is 5 in. dia. × 2 in. long, and the stator is $8\frac{1}{4}$ in. o.d. and has eight poles to match the rotor.

The air gap is only five thou, and it was a little job requiring more than ordinary patience to get the stator set about the rotor with a fairly equal air gap all round. ▣

Chuck for holding narrow rings

THE difficulties of machining narrow rings can be greatly reduced by using the simple chuck unit shown in the illustration.

Contrary to usual practice, the ring to be machined is gripped at its bore instead of at its periphery. This allows the periphery and one face to be machined at one setting.

The ring can easily be reversed in the chuck for the machining of its other face.

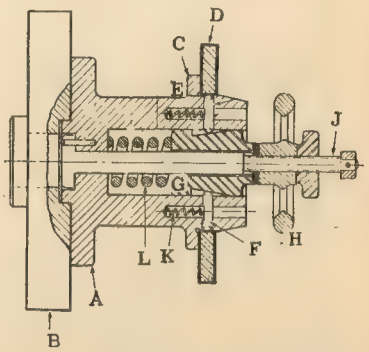
The chuck body *A*, attached to the lathe by the backplate *B*, has a collar *C* against which the workpiece *D* fits. The workpiece is centred by a parallel land *E*.

It is gripped in the bore by four symmetrically arranged, dome-ended rods *F* which are forced outwards as the cylindrical, tapered plug *G* is moved towards the left under the action of screwing up the handwheel *H* on bolt *J*.

Springs *K* prevent the rods *F* from falling out when the workpiece is removed and spring *L* expels plug *G* when the handwheel is released, thus freeing the rods *F* and the workpiece.

The device is particularly useful for holding soft metal rings.

This has been digested from "Auxiliary Lathe Chuck," by W. M. Halliday, in the February issue of *Tooling*. The illustration is reproduced by courtesy of the author and the publishers. ▣



Cross-sectional view of chuck unit for holding soft rings

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Hull from plastic

I am about to start on a new model power boat, the hull of which I want to construct from some kind of plastic material. Unfortunately, my knowledge of plastics is very limited. Can you give me any assistance, please?—W.G., Glasgow.

▲ *The material generally employed for building up boat hulls and similar structures is Fibreglass, which consists of woven glass fibre impregnated with a synthetic resin. This, when solidified, produces a reinforced plastic sheet capable of being built up to any desired thickness.*

It is necessary to make a mould to either internal or external shape of the hull as may be most convenient, due allowance being made for the thickness of the material in either case. Generally speaking, for the best possible finish the internal shape mould is preferable.

The mould can be made of any convenient material, including wood, plaster or concrete, but care must be taken to see that it is possible to remove the finished hull from the mould after it has set. To prevent sticking of the plastic material, the mould must be coated with wax or similar non-adhesive preparation. The glass fibre, in the form of woven matt or chopped fibres, is laid evenly on the mould and it is necessary to tailor it to complex shapes or to use the chopped fibre to build up contours. Each layer is impregnated with the resin and allowed to set before further layers are applied.

Materials for Fibreglass construction are obtainable from Ferguson and Timpson Ltd, 75 York Street, Glasgow, C.2.

One further point: it may be necessary to get a fair amount of practice in the technique of using this material before complete success is attained.

Barograph ink

Can you give me a formula for making barograph ink?—J.P.D., Folkestone, Kent.

▲ *No details of this ink are available at present and, in view of present difficulties in obtaining suitable chemicals, it would probably be less expensive to get it ready made. It can be supplied by makers of barographs, such as Negretti and Zambra Ltd, 122 Regent Street, London, W.1, and Baird and Tatlock (London) Ltd, Freshwater Road, Chadwell Heath, Essex.*

Filling blowholes

Is it possible to fill external blowholes in a large casting prior to painting—and, if so, the method of making a filling; secondly, can 2 in. o.d. tubes be expanded satisfactorily?—T.P., Berkhamsted, Herts.

▲ *Rawlplug plastic metal is excellent for filling blowholes, etc., in large castings. It dries very hard and can be easily smoothed off with a file before painting the casting.*

Secondly, not only is it possible to expand 2 in. dia. tubes satisfactorily, but it should not be difficult to make up a suitable expander for the purpose. Descriptions with illustrations of expanders made by readers have been published in MODEL ENGINEER.

Burner wanted

I have made from scrap a steam-engine (cylinder $\frac{1}{2}$ in. bore × 1 in. stroke) but it hasn't much power. Although I have tried all the local shops I can't get a burner or lamp to work this engine. What do you suggest? At the moment I am using a polish tin with methylated spirit.—J.J.G., Manchester.

▲ *You do not state what particular type of boiler you are using and it is, therefore, difficult to advise you as to the best type of burner to use. Methylated spirit, although easy to use in a simple type of lamp, is not a highly-efficient fuel. A blowlamp or a Primus type of vaporising burner, burning paraffin or petrol, would be a much better proposition.*

A simple type of spirit vaporising burner, much more efficient than the simple wick type, was illustrated in MODEL ENGINEER *of 24 January 1957. This would be quite a simple burner to make, but is only suitable for vertical boilers or other types in which the complete burner can be placed underneath the boiler.*

Fuel for model diesel

I have recently purchased an E.D. Bee 1 c.c. diesel and have started running it on some proprietary fuel which quite obviously contains ether. The price of this fuel was, in my opinion, rather high and I should like to compound some suitable fuel myself. Thus, could a fuel be made up by mixing suitable proportions of petrol with, say, paraffin or commercial diesel together with a small quantity of heavier oil to act as a lubricant? If you consider that this or a similar mixture would not be successful, could you let me have details, please, of a suitable standard mixture?—I.B.D., Chandlers Ford, Hants.

▲ *A good many experiments have been made with various fuels for these engines and some users have reported success with fuels of similar composition to your suggestion. But generally speaking, a certain proportion of ether in the fuel is considered a necessity. The reason for this is because in small engines the temperature which can be attained on compression is limited by the rate at which heat is conducted away from the mixture in the cylinder and, therefore, it is necessary to have a priming agent in the fuel having a relatively low ignition temperature. Ether is the most readily obtainable spirit which can be employed for this purpose, and it is unlikely you will do better than use the recommended fuels.*

The high price of fuel is one of the disadvantages of this type of engine which prevents it from being more extensively employed in larger sizes.

Purley Grange details

I am building *Purley Grange* in $2\frac{1}{2}$ in. gauge, but lack information on the following: the drill size for the hole in the blastpipe nozzle; the distance of the top of the nozzle from the petticoat pipe; the number of holes in the blower ring and the drill size.—R.W.F., Reading, Berks.

▲ *The size of the hole in the nozzle and the distance of the top of the nozzle from the petticoat pipe should be such that the escaping column of exhaust steam should fill, or very nearly fill, the chimney. This column of steam escapes at a total included taper of 1 in 6, and it should, therefore, be easy to make a sketch of this from which you can easily deduce the dimensions you require.*

As to the holes in the blower ring, there are usually four, equally spaced round the ring and drilled so that the

jet from each is slightly inclined inwards. The holes should not be larger than No 70 drill.

Replating method

I am reconditioning my motor cycle and find that the nuts and bolt heads have lost some of their protective coating. Can you advise me, please, of a replating method—and, since some of the parts are bright, will tin plating adhere permanently? —A.J.N., Dublin.

▲ *You would find the replating of nuts and bolt heads a rather difficult operation as it would be necessary to strip the existing plating completely and clean the parts chemically before replating.*

Tin plating would not be sufficiently hard for these parts—they have to withstand fairly rough treatment. But there are several forms of surface treatment which could be used to protect them against rust. These, however, call for special chemicals and apparatus.

The Percival Marshall handbook "Electro-plating for the amateur" (price 5s.) would give you full particulars of the method for plating with either nickel or chromium.

Cutting clock gears

I am building the M.E. clock and seek your advice on the use of my Quickset dividing attachment (90 to 1) for cutting gears. Specifically, can you give me a method of working out the number of turns and holes for the wheels of this clock?—A.F.F., Eastbourne.

▲ *If the ratio of the worm gear is 90 to 1 as you suggest, this means that the effect is to multiply the number of the divisions on the plates by 90 and any gears whose teeth are sub-multiples of this product can be cut with the attachment.*

Suppose, for instance, that a division plate having 48 holes is used. The product will be:

$$48 \times 90 = 4{,}320.$$

To cut a wheel of, say, 60 teeth, the worm will have to be turned through a distance corresponding to 72 holes, which will be $1\frac{1}{2}$ turns. For other combinations the proportions can be worked out in the same way, but it will be clearly seen that the product of the number of holes in the plate and the teeth in the worm must necessarily be a multiple of the number of teeth to be cut.

Petrol engine

I have, as supplied by you, a set of prints for Edgar T. Westbury's 30 c.c. petrol engine and would appreciate further details as follows:

1. From whom are castings available.
2. What materials are required for all parts.
3. Which parts need to be hardened. —A.D., Brighouse, Yorks.

▲ 1. *Castings are available from W. H. Haselgrove, 1 Queensway, Petts Wood, Kent.*

2. *The main structural castings may be obtained either in gunmetal or aluminium alloy, the latter being recommended in cases where weight must be kept to the minium. Working parts such as the crankshaft, camshaft, etc., should be in good quality steel, bearings in bronze and pistons in either cast iron or aluminium alloy.*

3. *It is an advantage to harden the surface of any steel parts which are subject to wear, viz., camshaft and crankshaft, but in view of the risks of distortion it is more common to make these from a steel which resists wear effectively without hardening. Tappets and gudgeon pins, also rockers, should be of mild steel, case hardened.*

Removing deposits

Can you suggest a remedy for eliminating gummy deposits in the fuel system of small-boat engines? I have been experiencing a lot of trouble in this respect during recent weeks.—W.H.S., Brentford, Middx.

▲ *Deposits left by modern motor fuel are often objectionable and difficult to remove. They seem to collect particularly in containers which are left with petrol in them for any length of time and are not readily soluble.*

An alkaline solution, such as ordinary washing soda, should be effective, but great care would have to be taken to eliminate it completely by washing out with several changes of clean water and then thoroughly drying. So long as very strong caustic alkalies are not used no damage would be done to the tank or pipes.

Solvent liquids, such as acetone o trichlorethylene, might also be tried.

Leading the crank

It is my intention to turn the crank axle for my *Titfield Thunderbolt* from the solid, partly because I cannot make a success of the fabricated version and partly as an interesting exercise. Is it correct for the forward gear eccentric to lead the crank by 90 deg. and the reverse eccentric to trail by 90 deg.?—R.K., Walton-on-Thames, Surrey.

▲ *The forward gear eccentric should lead the crank by 90 deg. plus the angle of advance, and the reverse eccentric should trail the crank by 90 deg. plus the angle of advance. The advance depends upon the lap and lead that you are using.*

BROWSING AMONG THE P.M. BOOKS

WHILE the model railway movement expands, the modern dwelling house shrinks. Before the war the enthusiast who lacked room could often find refuge in the cellar or attic, but nowadays the average house is built with nothing underneath and very little on top. The cellar does not exist and the so-called attic is usually a forbidding region which we enter with difficulty and trepidation when the water tank has to be lagged.

These difficulties do not deter the genuine enthusiast. On the one hand he has taken to working in the smaller gauges, and on the other he has turned to the possibilities of the garden where he can use a larger gauge than would be convenient in even a big house and allow his ingenuity fuller play than is ever possible indoors. There is no end to what can be done in quite a modest garden, and the modeller who chooses this kind of layout has the satisfaction of combining two very pleasant interests, one represented by the signal and the other by the shovel.

But how does one build a garden railway? To this question which more and more people are asking, including many who are gardeners rather than modellers, R. E. Tustin gives the answer, from his own experience and special knowledge, in a Percival Marshall book illustrated with photographs and drawings that will make the reader itch to begin his own garden railway.

Probably the biggest deterrent to many is the reported experience of those who have used unsuitable track without realising that it was unsuitable. If we listened to the woeful tales of people who relate everything except their mistakes there would be no model engineering at all! The wise man seeks the practical expert. For advice on garden railways he goes to Mr Tustin who has built a highly attractive garden railway of his own, has studied other people's and is able to describe with clarity and humour all that he has learnt about track, gauges, layouts, soils, bridges, tunnels, levels, buildings, signals, rolling stock and all the rest.

While you are reading *Garden Railways* (Percival Marshall, 10s. 6d.) keep an eye on the local pets and try not to site a gantry signal where the cat jumps over the garden wall! —J.M. ▣

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

STERNWHEELERS

SIR,—Sternwheelers ply regularly on the Magdaline usually pushing one or two laden barges and carrying a number of passengers.

I am at present trying to get some details but I would estimate that the vessels are, perhaps, 200 to 250 ft long × 40 to 50 ft wide. They probably draw only about 6 ft of water.

All appear to be of similar construction comprising basically a hull which is practically rectangular in plan on which are mounted in order from stem to stern a windlass, the boilers, fuel tanks, auxiliary machinery and, lastly, the two cylinders which drive direct on to cranks on the sternwheel shaft.

Over the machinery is a structure of steel girders which carries one or two decks of cabins, public rooms, kitchens, etc., and above these is the navigation bridge.

Colombia. H. P. EDWARDS.

SAFETY REFINEMENT

SIR,—I read with interest Mr R. Mapplebeck's article on a blowlamp torch. May I add just one refinement which I once found useful in saving my boat from complete destruction?

I soldered a $\frac{1}{16}$ in. tube into the tank with the end soft soldered to keep the air in. This end I led into another tube let into the boiler with, of course, the inside end hard soldered.

When the boiler ran dry the heat melted the soft solder on the end of the tube from the lamp, let the air out and extinguished the flame.

Knowle, Bristol. ERIC J. W. EVANS.

M.E. CLOCK

SIR,—I congratulate MODEL ENGINEER on the fine series of articles on the M.E. Musical Clock and particularly the author, whose treatise has been most elevating.

However, I was surprised at some of your readers' comments on the gearing and cutter problem, also by others trying to "blind the issue with science." This is understandable from the "unlettered and armchair theorists," but as one who has been instructed by Mr Reeve in the art of clockmaking and who has made several clocks to Mr Reeve's designs, I can say that the problems put by your readers are largely non-existent.

The merits of tooth forms so ably expounded in theory are not found generally in practice. The cutter problem should be no bar either. If a constructor can make a clock, he can make all his own cutters just as easily. About four years ago M. J. Sterem contributed to MODEL ENGINEER what I consider to be the answer to an amateur's prayer in the art of forming clockwheel flycutters. I have adopted his method exclusively, with a couple of minor modifications and the results leave nothing to be desired.

In my latest clock—a Graham regulator beating seconds—I cut the whole train with my own home-made cutters, to gear up with my own lantern pinions. The clock performs satisfactorily on 1-2 lb. driving weights, but in practice 2-4 lb. has been added to provide an ample margin of power.

Its timekeeping and reliability leave nothing to be desired. It compares favourably with some of the best-made regulators by professionals. So much for all the "ado" about cutters. I suggest your would-be constructors get on with the job and leave the finer points of theory to the armchair critics who probably have never made a clock and never will.

I hope we will soon see some regular horological features from the able pen of Mr Reeve.

Sydney, Australia. H. H. KNIE.

SAFETY-VALVES

SIR,—Thank you for the answer to my query on safety-valves for 3½ in. gauge locomotives. Thanks to a helpful friend in Maidstone I obtained a copy of MODEL ENGINEER printed in 1929 in which L.B.S.C. describes a full pop variety, which seems to be the answer.

I have now seen one of these working and the performance is pretty impressive.

Botley, Hants. J. H. B. URMSTON.

EARLY ENGINES

SIR,—I prefer your magazine because of its diversification and its frequent reference to the early models of industrial steam-engines, boilers, etc.

Possibly, you might expand this interest with descriptions of models

The DAVID ARANGO U, *one of the largest and best-equipped river sternwheelers*

Right: Three drawings of stationary-engine chimneys. (a) with spark arrester; (b) with bonnet to keep out rain; and (c) typical installation with the smoke-box and flue outside

of early manufacturing plants, such as sawmills, potteries, foundries or machine shops with which these engines and boilers could be combined to produce model industrial plants suitable to exhibit in club or museum.

Fort Edward, New York. WILLIAM H. HILL.

STEAM PLOUGHING

SIR,—I am always pleased to read any items of news concerning traction engines in your excellent journal, and your readers may be interested to hear of a set of steam tackle which I visited a short time ago, near Sawbridgeworth, Herts.

The engines are Fowler Nos A.A. 14383/4. A seven-furrow balance plough was being used and everything, including the well-equipped living van, was kept in first-class order.

Other implements used included heavy cultivator, harrows, hole drainer and dredgers. The set, along with two others, is usually working all the year round in the Herts. and Essex area.

The four men who worked the tackle were very courteous and helpful during my visit.

London, N.14. CLAYTON H. WILLEY.

ENGINE CHIMNEYS

SIR,—The maker of the free-lance undertype engine [MODEL ENGINEER, April 18] could not have seen or had the chance to examine any full-size examples of these self-contained power units, or he would not have made such an absurd little chimney.

The full-size engines had, if they could not be connected to some existing flue, a chimney at least 8 ft high from the smokebox, and I show three sketches of how they finished at the top.

When driving a sawmill, or being used on a tea plantation, a spark trap like sketch *A* was generally applied.

Where the chimney passed through a roof, and a good class job was insisted upon, a construction like *B* was adopted to prevent rain getting in.

Steam ploughing engine at work in Hertfordshire

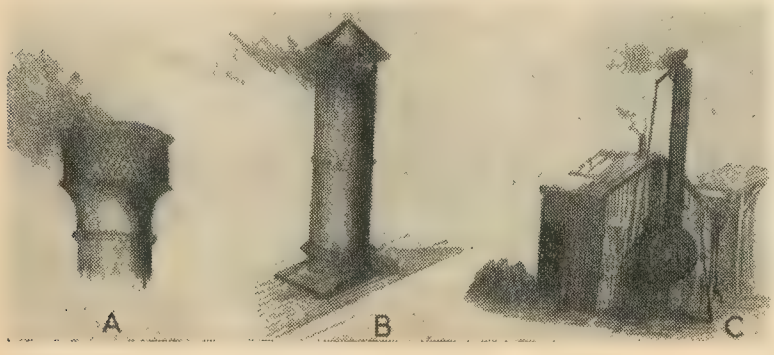
Often an overtype, which had its boiler supported at the front end by a stool under the barrel, was installed in a mean little shed with its hot and dirty smokebox put outside, as sketch *C*.

The chimney at *C* has a lid and a long rod reaching down so that when not working the lid fitted snugly and kept rain and snow out; moisture mixing with the soot will eat through an engine smokebox in a very short time and, passing back through the soot in the bottom of the box, attack the lower part of the front tubeplate, with risk of a failure there.

I am not criticising the curved spoke flywheel; Mr Clark's splendid books show that several firms in East Anglia used these on small stationary engines, but one wonders whether it was meant to be a single casting.

All the data for a perfectly correct model are to be found in *A Textbook on Steam and Steam-engines* (C. Griffin and Co., 1890), pages 180 to 185, scale $\frac{3}{8}$ in. to a foot, where "a straight chimney of wrought iron 8 feet long" is specified.

Mill Hill, N.W.7. H. H. NICHOLLS.



IT WAS 'HESPERUS'

SIR,—In a letter [Postbag, January 24] recalling some memories of the Kent and East Sussex Railway during the war I mentioned seeing a small saddle tank bearing a name *Tre-Pol-Pen*. I have since found out that this engine was in fact the *Hesperus*. I can only assume I became confused with an engine bearing the former name which we had on the G.W.R. some years ago, and I apologise if I confused any reader familiar with the K. and E.S.R. engines.

Oxford. C. TURNER.

JAMIESON'S MANUAL

SIR,—Mr H. H. Nicholls [Postbag, April 11] has drawn attention to Professor Jamieson's *Elementary Manual on Steam and the Steam Engine* but it is perhaps as well to point out that in the thirteenth edition published in 1911 the author changed the title to *Elementary Manual on Heat Engines: Steam, Gas and Oil*. In his preface to this edition the famous professor states his reasons for the change:

"In this improved up-to-date form, it should be of still greater usefulness to teachers and students, because there can be no doubt the good old steam engine is, in certain cases, being replaced by one or other of these more modern prime movers. In cities, for example, printers, cabinet makers and many other works have replaced their steam engines by gas engines, using the town gas as fuel....

"Then again, oil engines have proved to be very reliable for driving all kinds of road vehicles, as well as for launches, pleasure yachts and aeroplanes. But the extraordinary success of the Diesel oil engine has recently induced shipowners to specify

POSTBAG . . .

that their vessels of 3,000, 5,000 and 9,000 tons shall be driven by such engines with heavy, crude, cheap oils as the energising fuels."

The author, therefore, added two more "lectures"; one covering the subject of the gas engine and the other the oil engine.

I have in my possession a copy of the fifteenth edition presented to me in the early days of my engineering apprenticeship towards the close of the 1914-18 war. Incidentally, this edition was revised by Professor Ewart S. Andrews in 1917. Even so, steam is still the main subject of the "lectures" and, in addition to the marine engines (steam) mentioned by Mr Nicholls, particulars of a number of steam locomotives are also given in this and earlier editions.

The most interesting of these is a tandem compound tank locomotive designed by M. du Bousquet for the Chemin de Fer de la Petite Ceinture de Paris. In addition to a table of test runs, a comprehensive specification of the engine is provided. A large folding plate provides complete sectional details of both the h.p. and l.p. slide-valve cylinders.

ERNEST A. STEEL.

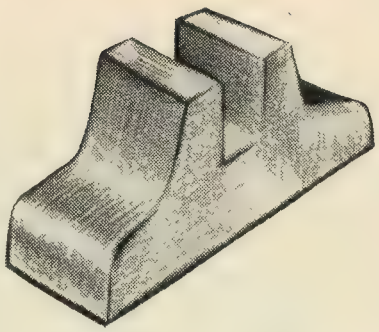
Princes Risborough,
Bucks.

COMPOUND T.E.s

SIR,—Surely the first compound T.E. was John Fowler's class B No 4102? This engine was to be seen in the demonstration field at the R.A.S.E. Derby Show in 1881. Also at the show was an entry from Thetford, a Burrell-Burall patent compound T.E. The design was quite unsuitable for a road engine and no more was heard of it.

The Foden compound appeared somewhere about 1887.

Norwich. R. C. STEBBING.



A simple chair casting designed by K. Sproston

CHAIR CASTING

SIR,—I wish to scale the C.P.R. Selkirk-type 2-10-4 locomotive down to 5 in. gauge as a live-steam model. If any other reader has similar interests I would be glad to hear from him. I served my time at the Vulcan Foundry when they made monsters for various world railways.

I am enclosing a small die casting which I designed and made in vast quantities for a friend who had exactly the same problem as your reader [T.A.H., St Columb, Cornwall, Readers' Queries, 21 February 1957]. These castings were milled down the slot 30 at a time to enable them to fit $\frac{5}{16}$ in. $\times$ $\frac{1}{2}$ in. mild steel strip. If T.A.H. is interested I will help him on a no profit basis.

Dundee. K. SPROSTON.

C.R. 769

SIR,—There is no mystery about where the model of C.R. 769, last seen at Rhyl, has got to. I was put on the trail of her owner while she worked at Rhyl by our chairman who gave us a very interesting account of his struggles to keep the engine on the road. He told me that his engine was built by the apprentices at St Rollox works, and that after our chairman had advised him that the boiler was no longer safe to run he parted with her to a man in Macclesfield.

Mr Wilfred Tucker, who knows him and who has made a special study of the Caledonian Dunalastairs, went to see the engine, which is now having all stays renewed and a new set of tubes fitted. He thinks that it was in fact made at St Rollox.

Some of the workmanship is typical of railway shops and in addition there is some evidence that it started out as a model of the earlier class, with lugs for the weighbar shaft below the frames which are also short for the later engine. It appears to have been altered to conform to the later type, with the weighbar shaft in a different position and no use made of the lugs.

Mr Willoughby who wrote on the subject was kind enough to send me a copy of MODEL ENGINEER published in October 1901, and Mr Harrison compared the photograph of the exhibition engine with his own snaps of the Rhyl engine and certainly there appeared to be minor external differences.

The Edinburgh Society, with whom I have had some correspondence, think that there were in fact two engines, the St Rollox job and that owned by Mr Croall. There does indeed appear to be some evidence to support this view.

If this is correct the mystery now is —where is the Croall engine?

Llanddulas, D. J. R. RICHARDS.
North Wales.

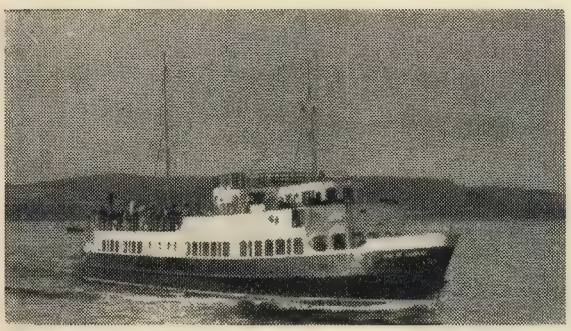
BLOWLAMP TROUBLE

SIR,—I was greatly interested in the article on the model *Campania* [April 11] as I have a very fine model of a steam yacht and I have the same trouble with the paraffin blowlamp.

Would your correspondent or any reader know where I could obtain a propane lamp, and also give some particulars about it?

I would like to know, too, if it would be possible to buy a Japanese control for radio in this county.

Mapperley, W. H. PEIRCE.
Nottingham.



MAID OF CUMBRAE *off Gourock*

The TALISMAN *leaving Largs. Her paddleboxes are now white*

CLUB NEWS

EDITED BY THE CLUBMAN

FOR the best sixpennyworth in England, go to Wombourne at the middle of next month. Wombourne is near Wolverhampton, and the West Midland Federation of Model Making Societies will be holding its rally there, on the Wolverhampton society's track.

The site—they arrange these things well in the Midlands—adjoins the Mount Pleasant Inn. One could not wish for a more accommodating track. The society has 600 ft of continuous way for 2½ in., 3½ in. and 5 in. gauges, and another 200 ft up-and-down portable track for gauges of 7¼ in., 5 in. and 3½ in.

Opening time—at the track—is 2 p.m. on the first day, June 15, and 11 a.m. on the second. Car parking costs nothing. Federation members and friends are admitted by sixpenny ticket, and meanwhile secretary A. F. Allsop may be found at 25 Dunster Street, Leicester (telephone 87207).

CUP TRIALS

Whitsun looks like being one of the busiest holidays in the year—and one of the happiest if we are granted fine weather.

Secretary A. Senchell of the **Chingford and District M.E.C.** (95 Roberts Road, London, E.17) welcomes competitors for the H. E. White Cup at the miniature locomotive nomination trials to be run jointly by **South London M.E.S.** and the Chingford club on Whit Sunday.

Those unacquainted with the Ridgeway Park track at Chingford, where the event is to be held, may care to know that there is a continuous run about one-fifth of a mile in length, built for 2½ in., 3½ in. and 5 in. gauge engines, with 25 ft as the radius of the sharpest curve.

Entrants for the live steam trials are expected to produce a certificate of boiler test and to be ready at the time stated on the starting sheet, names and addresses for which should be submitted as far as possible in advance.

Light refreshments will be provided during the afternoon.

AT HOME

For members of **North London S.M.E.** the holiday programme begins on the Friday night with an At Home at the New Barnet headquarters in Prospect Road. The occasion is informal.

Then, on Whit Monday, the locomotive section meets on the track at Arkley Barnet. Since last August, with work continuing through the winter, the track has been extended to give a continuous run of about 1,500 ft. So far this happy society has built 725 ft of concrete and constructed 500 ft of rail.

Secretary D. G. Gordon's address is 60 Victoria Road, New Barnet, Herts.

URMSTON'S WELCOME

All readers of this page—clubs and unattached modellers alike—are invited by **Urmston and District M.E.S.** to its official opening of the season on Whit Sunday and the Bank Holiday. Refreshments will be on sale at moderate prices.

The invitation issued by secretary S. E. Rowland (6 Primrose Avenue, Urmston, Manchester) is brief and cheerful: "Bring your locomotives and spend the day."

REGATTA IN KENT

Another Whitsun event, on the Saturday, is the annual regatta of **Welling and District M.E.S.** at the Belvedere Recreation Ground, Belvedere, Kent. R. Bittle, of 3 Spring Vale, Bexleyheath, the power boat secretary, tells me that all **M.P.B.A.** members are welcome.

The programme, which is for free-running boats only, opens at 2 p.m. with the nomination event. There is a steering competition, a club relay nomination, a radio-control event and a towing competition—given by Mr Bittle in that order.

Will intending competitors and visiting clubs please advise secretary B. H. Cousins (77 Standard Road, Bexleyheath, Kent; Bexleyheath 7273) in reasonable time so that no one will go hungry during the afternoon?

PONDSIDE PICNIC?

Talking of hunger, I hope that no one suffers any pangs at the joint regatta to be held by the **Wallasey** and **Crosby** clubs on June 16.

The clubs meet—with all clubmen welcome—at Central Park, Wallasey, but no arrangements can be made for refreshments. Will anyone worry? If I were going to this regatta I should stuff some food into my pocket; and I am sure that I should enjoy the occasion just as well.

Secretary D. Furmston of Crosby Model Club lives at 37 Thornbridge Avenue, Litherland, Liverpool 21.

SHEFFIELD'S SHOW

Still another invitation! Anyone who would like to have a model in the Sheffield Joint Model Societies Exhibition at St Mary's Community Centre, Bramall Lane, Sheffield, on June 13, 14 and 15 should communicate with secretary Ivan R. Law of **Sheffield and District S.M.E.E.** at 10 Hurlfield Drive, Sheffield 12. Old friends of the club will note the change of secretary.

OUT OR IN . . .

If the weather is fine, the next meeting of **Eltham and District L.S.** will be at the track site in Avery Hill Road on June 3, with a working party busy on general maintenance from 7.30 p.m. The alternative, in rain, is an indoor meeting at headquarters.

Eltham expects a very busy summer.

M.E. DIARY

June 1.—Fifth West Riding Rally (June 1 and 2, 10 a.m.). Birmingham S.M.E. outing to Wye Valley, Snow Hill, 8.30 a.m. Bristol S.M.E.E., "The Internal Combustion Engine," J. Rose, Folk House, 7.30.

June 3.—Eltham and District L.S. meeting at track (working party), 7.30 p.m.

June 5.—North London S.M.E. miniature railway section, H.Q., 8 p.m.

June 7.—Rochdale S.M.E.E. open meeting, Lea Hall, 7.30 p.m.

June 8.—Pennsylvania Live steamers' annual live steam meet; Kenneth Souser's Farm, Darby and Buttonwood Roads, Paoli, Pennsylvania; 2½ in., 3½ in. and 4¾ in. gauges. All live steamers and their engines invited (June 8 and 9). Appleford Traction Engine Rally, Bridge Farm, Appleford, first event 2 p.m. (open noon). Proposed engine rally at Hatfield Park, Herts. Welling and District M.E.S. annual regatta, Belvedere Recreation Ground, Belvedere, Kent, 2 p.m.

June 9.—South London M.E.S. and Chingford and District M.E.C. annual joint miniature locomotive nomination trials, Ridgeway Park, Chingford.

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19/20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

CLASSIFIED ADVERTISEMENTS

★ Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

★ Rates for displayed advertising in this section. Trade 35s., Staff 45s., per single column inch. (Column width 1⅞ in.)

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

New "Hoover" Motors in manufacturers' pack, ½ h.p., 400/440 volts, 3-phase, 50 cycles, 1,425 r.p.m., continuous rating, ball-bearing, foot mounting, ⅝" shaft. Perfect condition. Cash price £6 7s. 6d. each, carriage paid, or £2 deposit and 6 monthly payments of 16s. Limited number only. Orders to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, W.4. (Telephone: CHIswick 3416).

Myford Super Seven with quick change gearbox, motorised on stand. Two screwed body chucks, fixed steady, adaptors for 8 mm. and ⅜" collets. All in excellent condition, Hampshire area, offers. Enquiries—BOX No. 8518, MODEL ENGINEER Offices.

1956 Myford S7. Complete motorised, new condition, chip tray, cabinet stand. List £120-£75. Chucks, Griptru, 3½", £7 10s. 6" in. £4. 4-tool turret, £2. Dividing attachment, £11. Taper turning attachment, £8. Cut-off slide, £8. Vertical slide, £3. Most small Myford accessories available. Pacera L.B.1 ½" motorised bench drill, £30. Machine vice, £4. Pools milling machined, £25. Vee drive unit, motorised, £12. Machine vice, £3. Hoover motors, latest ½ h.p., £7 10s. 1/3 h.p., £6 10s. All equipment 230-240 volt. A.C. single-phase Marico knurling tool, £4. Rotary table, £5. S.A.E. list, drills, cutters, collets, etc.—HAYWARD, 19, Alsford Road, Purbrook, Portsmouth. Tel.: Waterlooville 3047.

Home-Master Workshop. All-in-one units, £14 10s. or £2 10s. deposit and 8 monthly payments of £1 15s. Will be sent carriage paid on receipt of deposit. (Money back guarantee if machine is returned within 7 days.) Write for/send orders to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, W.4. Telephone No. Chiswick 3416. Free 36-page booklet on application.

Drummond Treadle flat belt lathe stand, £6 10s. Eleven No. 1 taper drills ⅛"-17/32", £1 10s.—ROBINSON, "Milstar," Mill Cross, Denmead, Portsmouth.

10" Bandsaw. 3½" woodturning lathe, etc. Enquiries s.a.e.—T. WHITFIELD, 16, Hazelhurst Avenue, Beckfoot Lane, Bingley, Yorks.

Harrison 6" Screwcutting Lathe. All geared head, good condition, £175. Toolpost grinder, microtest. As new, £35.—42B, Johnson Road, Bromley, Kent. Rav. 7413.

Picador Spindle, new, complete. 10" ripsaw, chuck, 55s. c.o.d.—7, Evanston Gardens, Ilford.

Black and Decker, Wolf accessories, second-hand, sold separately. S.A.E. list—DENBY, 64, William Street, Long Eaton, Nottingham.

Sale. No. 1 Speedily jack, 8" high, 4" lift, £1. ½ pint Phoemax blowlamp, £1. One and three ton Felco chain-blocks, £4 and £5, carriage extra. Box of 30 coins including Geo. III and Geo. IV crowns, £2. No. 2 semi-rotary pump, fittings, 30s. Grindstone dressing tool, £1. Folding push-chair, cream, £1. Boy's cycle 6-8 years, 30s. S.A.E., postage extra. Box No. 8528, MODEL ENGINEER Offices.

Capstan Lathes. Two only, spindle end to capstan face 7¾", spindle to bed top 3". Bar capacity ¼", swing over bed 6". Without motor drives. Slightly damaged in storage, £18 each. Metal cabinets (one only) for above, £8, plus carriage.—R. SOUTHERN & CO. LTD., Wakefield Road, Brighouse, Yorks.

Wanted. ML7 or similar, cash. Would purchase workshop. Would collect London area.—2, Isabella Road, Homerton, London, E.9.

For Sale. Boxford 3½" plain precision lathe and accessories, motorised, ½ h.p. 230 volt, 1-phase, new condition, £44. Also 3½" gauge "Iris," chassis unfinished, £6.—L. HOLBROOKE, 4, Ottcham Close, Polegate, Sussex.

Wanted. 6 or 4 post 2 M.T. tailstock turret, good condition.—SCOTT-JONES, Sadler Street, Bognor Regis.

Instrument Lathe 2". American Watch Tool Co. Guaranteed as new and perfect, scarcely used, with collets, £20 (cost £60). This is a superb precision tool of U.S.A. leading make, in absolutely unmarked condition. Suitable clock, watch, instrument, O and OO work.—Box No. 8535, MODEL ENGINEER Offices.

8" Circular Saw, 230/250 volt, £12 10s. Wolf TG8, grinder/polisher, 230/250 volt, new, £25. Assortment mops, wax, 30s. Leaver shearing machine Samson, 50s. New drawing board 33" × 24", 25s. Tee-square, 7s. 6d.—22, Cheney Street, Eastcote, Pinner, Middlesex.

Drawing Boards. Pine, slotted backs, slot screwed battens, hardwood straight-edges. 32" × 23", 42s., carriage 5s., 23" × 16", 21s., carriage 3s.—Box No. 8544, MODEL ENGINEER Offices.

4" × 16" Adams round-bed lathe, chucks, tools, stand, motor, starter, £30 o.n.o.—Box No. 8543, MODEL ENGINEER Offices.

Almost New Myford ML7, motorised, clutch unit, 6" chuck, all tools, drills, taps, vernier, micrometer, pedestal drill Britannia, part complete. Boiler materials, exchange good M.G. sports car. Write—TERRELL, 19, Green Avenue, Astley, Tyldesley, Manchester.

Lathe, Workshop Equipment wanted, exchange 1949 Ford Eight engine, complete.—READER, Russells Home, Hempstead Road, Watford. Phone: Gadebrook 6767.

ML7 on Stand with motor, Burnerd s/c chuck, unused, £85.—Box No. 8542, MODEL ENGINEER Offices.

Wanted. 6½"-9" s.c. lathe. 0"-½" bench drill. Pedestal drill to take taper shank, drills. Also bench grinder, shaper and milling machine. Please send full details, condition and prices, London area.—Box No. 8545, MODEL ENGINEER Offices.

MODELS AND FITTINGS

We Purchase good quality live steam locomotives, stationary engines, beam engines, traction engines, etc. Repairs and overhauls effected to locomotives from gauge 1 to 5" gauge. 3½" gauge weatherproofed sleepers, 18s. 6d. per 100.—CHERRY'S (SURREY) LTD., 62, Sheen Road, Richmond, Surrey. Telephone RIChmond 2454.

5" Gauge 0-6-0 "Butch" chassis and finished parts. Also boiler parts and flanged plates. With drawings, Kennion design, £35.—41, Ventnor Street, Weddington, Nuneaton.

KENNION'S CATALOGUES

Tool and Materials 9d.
L.B.S.C. Blueprint & Castings. 1s.
Refunded on first 20/- order

3½" G. Handrail Knobs
3s. 6d. dozen

OVERSEAS ORDERS A SPECIALITY
2 Railway Place, Hertford *Phone 2573*

10¼" Gauge Boilers, wheels, cylinders, drawings, etc., for "Royal Scot." Bargain prices—26, Hog Hill Road, Romford.

Twin Cylinder Blocks 2" × 3" crankshafts, etc., suitable 7¼" locomotives or 3" road engines. Also cylinders and parts for 10¼" locomotive.—ENGINEER, 92, St. Albans Road, Watford, Herts.

Sale. 4 19/32" Gauge locomotives, Southern "King Arthur" class 4-6-0, 4-4-2 tank, 0-6-0 Peckett saddle tank. All excellent models. Particulars.—HARRIS, 60, Holt Drive, Loughborough, Leics.

10¼" Gauge Locomotive, working order with approx. 200 yd. rail, £350.—Box No. 8522, MODEL ENGINEER Offices.

Exchange. Three 3½" Scale locomotives, plus new ML7 and equipment for 7¼" Pacific. Details—Box No. 8526, MODEL ENGINEER Offices.

Traction Engine Wanted. Private collector wishes to purchase 2"-3" scale Burrell or Fowler showman's engine or similar. Workmanship must be first class and condition also. Will pay top price for the right job and will call in person anywhere. Please—No poor quality, only the very best.—BYRTE, Whiteladies, De Maulley Road, Canford Cliffs, Bournemouth, Hants. (Phone : 77685.)

"Mollyette," £6. Stuart No. 10, 4 and 8, boilers also.—FURLONG, 10, Hall Road, Wanstead.

Wanted. 3½" Tender L.M.S. type for "Doris."—12, Gilroy Way, Orpington, Kent.

Royal Enfield Twin Cylinder stationary engine, reconditioned, guaranteed, £12 10s. Another, used, running order, £8. Wanted, early Scott motor-cycle.—H. E. CAUNT, 44, Rosedale Avenue, Leicester.

10¼" Gauge powerful locomotive, 6 passenger cars, large oval track and sundries, low price for quick sale.—Box No. 8538, MODEL ENGINEER Offices.

Gauge 1 Model Railway, electric, 5 detailed locomotives, large quantity rolling stock, fitted brakes, etc., 400' scale brass track and all sundries. All as new (cost over £1,000), £300 or offer.—Box No. 8540, MODEL ENGINEER Offices.

3½" Gauge garden railway, four coal-fired locomotives, passenger cars, quantity scale keyed track. Low price, below—

5" Gauge, 3 locomotives, passenger cars and portable track.—H-K, Spire House, The Park, Mablethorpe, Lincs.

For Sale. 15" gauge diesel hydraulic locomotive with driver's cab at each end. —Royal Anchor Hotel, Liphook, Hants.

Boilers, Multi-tubular, centre flue (coal and gas fired) and locomotive boilers made, standard sizes : 7" × 14", 11½" × 24", 9" × 18", 12" × 30", 10" × 20", 14" × 30". Other sizes made on request. Boiler repairs, welding and light plate work carried out. For sale. One 12" × 30" centre flue boiler, £20. One 7" × 14" multi-tubular boiler, £7. —E. THURSTON, 83, Pagitt Street, Chatham, Kent.

Two Miniature Railway steam engines 10¼" gauge, Royal Scot and Gt. Western, insurance certificates available. At bargain prices to clear. Apply—ENDERBY HANDSON, 26, North Street, Peterborough.

Urgently Required, Seal or similar engine. Your price paid, good condition essential.—Box No. 8546, MODEL ENGINEER Offices.

£6 Offered for vertical coal-fired boiler 14" × 6" approx., in good condition. W.P. 90 lb. minimum, soft soldered not considered.—146, Brereton Avenue, Cleethorpes, Lincs.

ELECTRICAL

Electric Welding. Distributors and agents for ferrous electric arc welding sets to operate from domestic plug, first class job for heavy and model engineers, 190 to 240 volts complete with equipment and supply of rods, £23 10s. Delivery from stock, H.P. terms if required. Agents for three countries.—SAFFRON WALDEN ENGINEERING Co., Thaxted Road Works, Saffron Walden. Telephone 3397.

A.C. Motors Selt Start, induction 200/250 volts, 50 cycles, 1-phase, 1,425 r.p.m., ¼ h.p., £4 2s. 6d., 1/3 h.p., £4 19s. 6d., ½ h.p., £6 15s. Pertect and guaranteed. Carriage extra.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/3.

Modern 5 H.P. Motor, Met.-Vick. repulsion induction type, 230/250/460/500 volt, 1-phase, 1,425 r.p.m., tully selt starting and almost new, £35. Auto-starter if required, £12 10s.—W. MOLDON, 364, King Street, London, W.6.

A.C. Motors, self-start, 220/250 volts, 1-phase, 1,425 r.p.m., ¼ h.p., 80s. 1/3 h.p., 90s. ½ h.p., 110s. All perfect.—W. MOLDON, 364, King Street, London, W.6.

Instrument Wire. Send s.a.e. stating requirements and let us quote lowest prices. —WARD, 34, Livingstone Road, Bath.

Nife Alkaline 6 volt, 200 amp hr., 5 cell in crate, £7 10s.—MELL, Longithington, near Rugby.

Electric (Compton Parkinson) water pump (Lister Dursley), new, a.c. motor, 220/230, 2.3 amps, b.h.p. ¼, 1,435 r.p.m. Offers to—LECOQ, 25, Walpole Street, London, S.W.3.

SITUATIONS

Young Man Wanted for testing prototype electro-mechanical instruments including development and implementation of test room techniques. Applicants should have basic workshop experience and be not less than O.N.C. standard. Apply in writing to—ELECTROFLO METERS CO. LTD., Test Dept., Abbey Road, Park Royal, N.W.10.

Locomotive Enthusiast with adequate room but no time, offers house (suitable three or four) rent free to counterpart prepared also to undertake gardening and house maintenance evenings and weekends. —TARVER, 39, Beech Grove, Preston, Lancs.

GENERAL

Spraying Handbook, 3s. 10d. post free. Paints, cellulose ali allied spraying sundries. Catalogue, 2½d.—LEONARD BROOKS, 25, Oak Road, Harold Wood, Romford.

Learn It As You Do It—we provide practical equipment combined with instruction in radio, television electricity, mechanics, chemistry, photography, etc. Write for full details to—E.M.I. INSTITUTES, Dept. ME 47, London, W.4.

Figure Photography approved service for enthusiasts. S.A.E. details.—BCM/NUART, London, W.C.1.

Compressors for Sale. Two pistons complete with air receiver, driving wheel and motor cradle. 180 lb., 2½ cu. ft., price £3. Motors a.c. and d.c. all types ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 13, Bell Road, Hounslow. Phone : Hounslow 3501.

Build Your Own Refrigerator. All components available at reasonable prices. Frigidaire units, £5. Single cylinder units, £4. New G.E.C. Coldair hermetically sealed and absorption units in stock. Hire purchase available. Heavy duty motors, 1/6 h.p. £2 10s. New chrome cabinet handle and hinges, £1 set. Money back guarantee. S.A.E. for list and schematic diagram.—WHEELHOUSE, 11/13, Bell Road, Hounslow. Phone : Hounslow 3501.

Guaranteed ! Easy-Home Constructed Refrigeration. Genuine domestic components. Not secondhand ice cream scrap. Modern hermetic G.E.C. units, gas, electric and oil silent unit. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated "Sealed system" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS., 50, Birchwood Avenue, Hackbridge, Surrey. Phone : Wallington 9309.

Air Compressors, tanks and accessories at far below list, from £5 17s. 6d., TV and lighting generator from £15.—TEDDINGTON, ENGINEERING Co. LTD., 29-31, High Street, Teddington, Middx. Tel.: Kingston 1193.

Young & Son. Material and tool dealers, watch, clock and jewellery repairers.—133, London Road, Chippenham, Wilts.

Build Your Own Car Heater. Complete set of new components, £3, post 2s. 6d. Radiators, 12s., post 2s. S.A.E. for list.—WHEELHOUSE, 13, Bell Road, Hounslow. 'Phone : HOU 3501.

Victor 16 mm. sound projector, 1949 model, with spares, good order. Offers.—R. NORTH, Rougham, Norfolk.

Model Engineer vols. 86 to 91 bound, vols. 100 to 109 unbound, all with index. Good condition, offers.—HIGGINS, 43, Baines Avenue, Blackpool.

Precision Engineers. Want ideas, patents bought.—Box No. 8399, MODEL ENGINEER Offices.

10 c.c. C.I. special 4-stroke engine. Bought at works, Jersey. New, tested, only £10.—SAVAGE, 227, Croydon Road, Wallington, Surrey.

Model Engineers for sale, unbound 1948 to 1952 and 1955 to 1956, offers.—MARSH, 7, English Martyrs' Place, Preston, Lancs.

500 M.E.s to 1954 (14 comp. volumes). Cash or exchange. Steam preferred.—Box No. 8534, MODEL ENGINEER Offices.

For Sale. Volume one and two "Motor Vehicles and Motors," by W. Worby Beaumont, date 1902 and 1906, in good condition. Offers—MALCOLM HOWELL, 3, Wygate Road, Spalding, Lincs.

Bomb Winch, all steel lift 5 cwt. to 10 cwt., £4.—H. ROYALS, 8, St. James Place, Hanford, Stoke-on-Trent, Staffs.

For Sale. Bound Vols. Model Engineer, 108, 109, 110, 7s. 6d. per vol.—25, Thistlemoor Road, Peterborough, Northants.

Model Engineer 1937 to date, offers. Six 3½" L.B.S.C. locomotives, £20 to £75 each. Two water cooled petrol marine engines, £5, £10 each, 20 c.c.—CLARK, 33, Erith Road, Belvedere, Kent.

Aqualung and compressor equipment.—PRYCE, 157, Malden Road, Cheam.

Bylock 230/50 volt spray unit, comprising motor, hose, paint reservoir and spray, £4.—WILLIAMS, 27, Avenue Road, Torquay.

Model Engineer July 53, Vol. 109 to Vol. 115, 7 Vol., 3 bound, all with index, £2 10s., plus carriage.—Corner House, Ashley Road, Thames Ditton, Surrey.

Constructors. Your own enlarger for under 30s. Plans, 2s. each.—BURNS, 6, Niddrie Road, Portobello.

INCREASE YOUR WORKSHOP CAPACITY BY ADDING any of the following :

Power Hacksaw, Drilling Machine, Hand Shaper, Compound Milling Table or Machine Vice.

Sets of machined castings for the above are obtainable with all heavy machining carried out by us and each machine can be finished with the aid of a 3½ in. lathe.

Full details of all the above, 1/- post free.

E. W. COWELL LTD

SYDNEY ROAD · WATFORD · HERTS

MITRE BEVEL GEARS

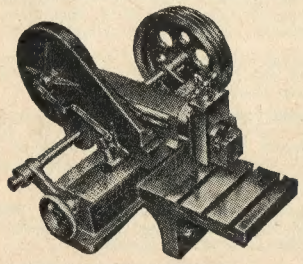
TEETH	D.P.	O.D.	BORE	MATERIAL	PER PAIR
16	48	.375″	.125″	STEEL	6/6
22	48	.484″	.156″	BRASS	8/-
22	32	.734″	.187″	OR	9/6
40	40	1.03″	.250″	DURAL	11/6
18	18	1.08″	.250″		11/6
30	16	1.97″	.500″	STEEL	£1-4-0
				BRASS	£1-10-0

SEND FOR COMPLETE LIST OF STANDARD GEARS

Phone: *S. H. Muffett, Ltd.* 20231

PRECISION PRODUCTION ENGINEERS

Mount Ephraim Works · Tunbridge Wells



HIGHEST QUALITY MATERIALS

"PERFECTO"

5 in. Stroke

POWER SHAPER

THREE SPEEDS TO RAM

Variable Feed

All Feeds Graduated

Price as illustrated

£32.5.6

Carriage extra

Supplied by tool dealers, or send 5d. stamps for details of three types of machine available

PERFECTO ENGINEERING CO. (Machine Tools)

60, STANLEY STREET, LEICESTER. Phone 20078

WATSON'S SPECIAL OFFERS

GRINDING WHEELS, 8″ dia., 3/16″ x 1″ bore medium grade, best quality. Price **10/-** each. Post 2/-.

SLEDGE HAMMERS, 7 lb. nosed with ash handle. **9/6,** carriage 2/6.

CANVAS TOOL ROLLS, 17″ x 10″ with provision for eight separate tools also pocket and fastening tapes. **1/4** each, **14/-** doz.

EX R.A.F. TOOL BOXES. Size 14″ x 9″ x 8″. Metal bound. **9/6** each. Carr. 2/6. LARGER SIZE 24″ x 12″ x 10″. Price **13/6,** carriage 3/6.

D.3 TELEPHONE CABLE. Approx. 1/3 mile on steel drums single strand PVC covered also extremely useful for many fencing purposes, etc., **12/6** per coil, carriage 3/6.

TWIN FLEX in 100 yard coils, best quality, **17/6** per coil. Post 2/-.

GEAR PUMPS. Beautifully made, will deal with a large volume of liquid. Inlet ⅜″, Outlet ⅜″, **30/-** each, post 3/-.

VACUUM PUMPS. Beautifully made to A.M. Specification size approx. 6½″ x 4½″. Outlet ⅞″, pr.ice **30/-,** post 2/6.

MAHOGANY FINISH BOXES Beautifully made with brass bound lid, and brass fastener 18″ x 8″, price **8/6,** post 3/-.

Hundreds of other Bargains available. Send 4d. Stamp for MONSTER ILLUSTRATED LIST.

EASTERN MOTORS, ALDEBURGH, SUFFOLK. Phone 51

Model Engineer

CLASSIFIED ADVERTISEMENTS

- PRIVATE RATE **3d.** A WORD
- TRADE RATE **6d.** A WORD
- MINIMUM 12 WORDS
- BOX NUMBER 1/- EXTRA

To "MODEL ENGINEER" Classified Advertisement Dept., 19-20, Noel Street, London, W.1

Please insert the advertisement below under

heading.....for.....insertions

Name .....

Address .....

Name and address, if to appear, must be paid for.

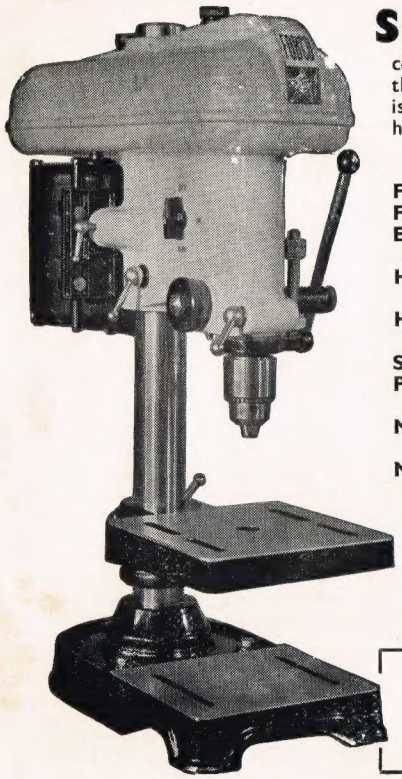
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

Three insertions for the price of two. ★ Private advertisers only.

Please write in block letters. REMITTANCE VALUE ..... ENCLOSED

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS LTD., Cordwallis Works, Maidenhead, Berks, and published by PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.
Registered for transmission by Magazine Post to Canada including Newfoundland.

M.E. QUERY COUPON MAY 1957



Specialist Advice and Service

cost no more, and our unique facilities enable us to offer a very real service in the fullest sense of the word. Any item of Workshop Equipment, large or small, is available on our well known **OUT OF INCOME TERMS.** We shall be happy to quote for your requirements.

	Cash Price	Deposit	No. of monthly payments	Amount
FOBCO STAR 0-½" bench drill ...	£39 1 6	£3 18 6	9	£4 5 3
FOBCO STAR pedestal drill ...	£44 9 3	£4 10 3	9	£4 17 2
EMCO UNIMAT, the complete Home Workshop	£27 17 6	£2 16 6	9	£3 1 4
HAIGHTON CADET 2½" lathe motorised on baseplate	£44 15 0	£4 10 0	9	£4 17 7
HAIGHTON CADET lathe less motor and baseplate	£29 15 0	£3 0 0	9	£3 5 5
SELECTA 6" bench grinder ...	£18 10 0	£1 18 0	9	£2 1 0
PICADOR 3/16" cap. sensitive type bench drill	£8 0 0	£1 0 0	8	£0 19 6
MYFORD M.L.7 bench lathe ...	£51 17 6	£5 4 6	9	£5 13 3
or		£25 19 6	12	£2 8 2
MYFORD SUPER SEVEN bench lathe	£78 10 0	£7 17 0	9	£8 11 3
or		£39 5 0	12	£3 11 1
QUICK CHANGE GEAR BOX for M.L.7 and S.7 lathes ...	£23 13 0	£2 8 0	9	£2 12 4

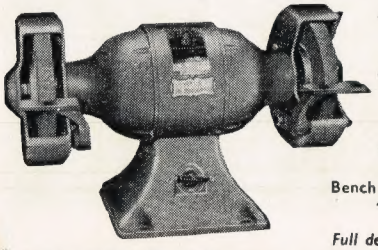
A 6d. stamp will bring you a copy of our comprehensive lists with details of blueprints, castings and materials for many "L.B.S.C." designed small steam locomotives; workshop equipment; boat kits and radio control equipment.

"The choice of experience"

A. J. REEVES & CO (BIRMINGHAM) LTD

417 MOSELEY ROAD, BIRMINGHAM 12 *Phone CALthorpe 2554*

Double-ended Grinders



Available from Stock

Double-ended Grinding Machine

Bench or Pedestal models available.

Sizes 6", 7", 8" & 10" dia. wheels.

Bench models only available 4½" dia. wheels.

Full details from:—

F. W. KUBACH Ltd. (Dept. Y), 12, Sylvan Rd., London, S.E.19

Telephone : LIVingstone 3311/3312

DO IT WITH "BRITINOL"!

For all soldering jobs connected with Model Making there is nothing like the 'BRITINOL' range for saving time and trouble. The 'Britinol' Spirit Blowlamp, as illustrated, gives a 3-4 inch hot clean flame, is completely automatic, quickly heats a small iron, or can be used directly on the work.

Price **7/6d.**

From Halfords Branches, Model & Tool shops. Also complete Kits, Paste and Cored Wire Solder.

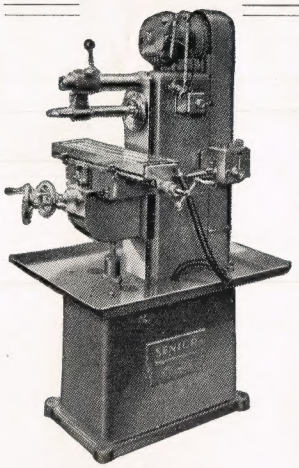
Send for free illustrated leaflet to—

BI-METALS (BRITINOL) LTD.

ST. MARY'S WORKS, BRIDGE ROAD, LONDON, N.9

Phone : TOTtenham 9413

THE "SENIOR" M.I. MILLER



This is a precision machine, superbly finished and built to Schlesinger limits. We believe it represents the World's most outstanding value in this type of equipment.

SPECIFICATION :

Model M.I.

Table	25" x 6¼"
Table Travel ...	15"
Cross Feed ...	5½"
Vertical Feed ...	11"

12 Spindle Speeds . . . from 50 to 1,660 r.p.m.

Full range of accessories can be offered

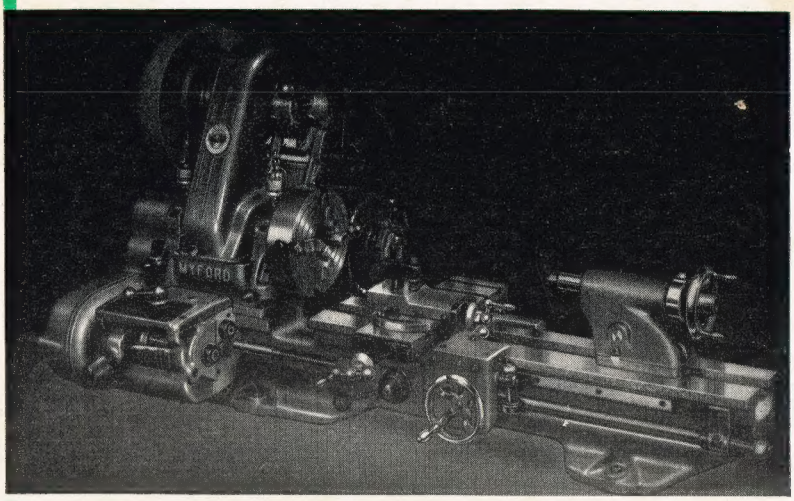
PRICE £290

Complete with Motor and Starter and Coolant Pump, Cutter Arbor. Write for brochure fully describing the machine with its range of Attachments.

T. SENIOR · ATLAS WORKS

LIVERSEDGE · YORKS

THE MYFORD ML7B & SUPER 7B LATHES



ML7B Quick-Change Lathe
(Note : Illustration includes extra fitments.)

are both equipped for the *RAPID SELECTION* of 48 *THREADS* and *FEEDS*

including Threads 8 to 56 T.P.I. and Feeds .0139 in. to finest Feed .0020 in. per revolution of spindle. The Gearbox is also available as an attachment for all existing ML7 and Super Seven Lathes and is easily fitted. OILBATH LUBRICATION ensures smooth, easy operation and long life. Literature covering Installation and Operation is supplied with the attachment. The many users of Myford Lathes will readily appreciate the great advantage of Gearbox facilities.

Send for full details NOW
(DEPT 8/42)

MYFORD · BEESTON · NOTTM

BURNERD *Precision Chucks*

OVER 40 YEARS OF SERVICE TO MODEL ENGINEERS THROUGHOUT THE WORLD.

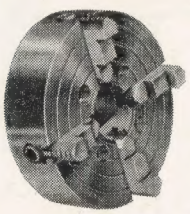
The following types are available

- 3 JAW SELF CENTRING *
- 4 JAW SELF CENTRING
- 4 JAW INDEPENDENT *
- LEVER SCROLL
- INSTRUMENT MAKERS
- 3 JAW GRIPTRU *
- 6 JAW GRIPTRU

** These models can be obtained for direct mounting to Myford ML7 and Super 7 lathes.*

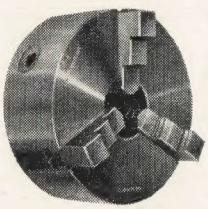
Ask your Myford dealer for details.

Every "BURNERD" chuck incorporates the "know-how" acquired during more than forty years specialised experience in producing lathe chucks to consistently high standards of accuracy and reliability.



4 jaw independent

Many thousands of model engineers and skilled craftsmen testify to the outstanding quality of "BURNERD" Precision chucks. Fit "BURNERD" to your lathe and enjoy years of trouble-free machining.



3 jaw self centring

IT COSTS NO MORE TO BUY THE BEST.

F. BURNERD & CO. LTD
5 BALFOUR PLACE, PARK LANE, LONDON, W.1
Telephone: GROSVENOR 4741/3. Telegrams: BURCHUCKS, AUDLEY, LONDON
Cables: BURCHUCKS, LONDON